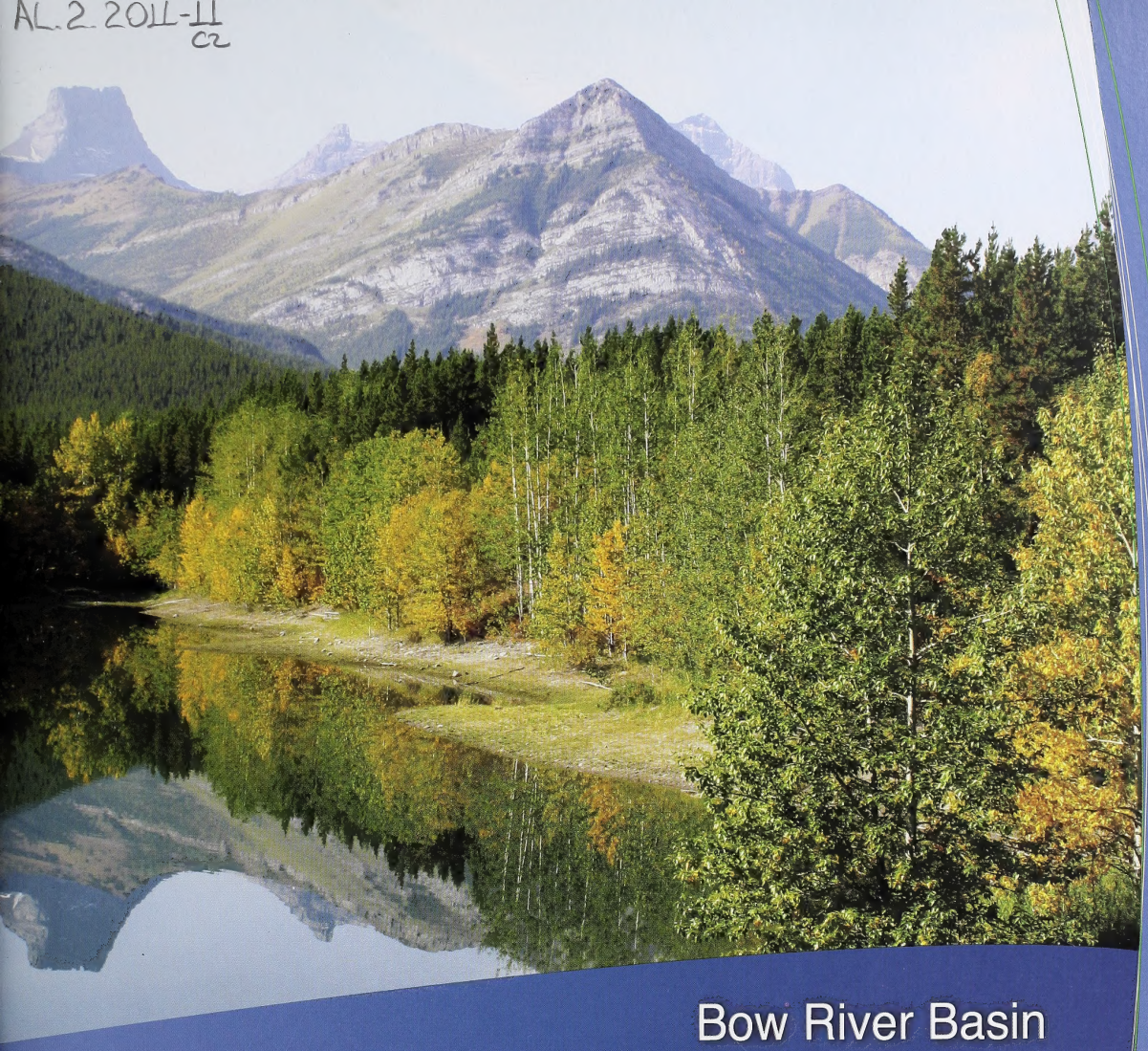
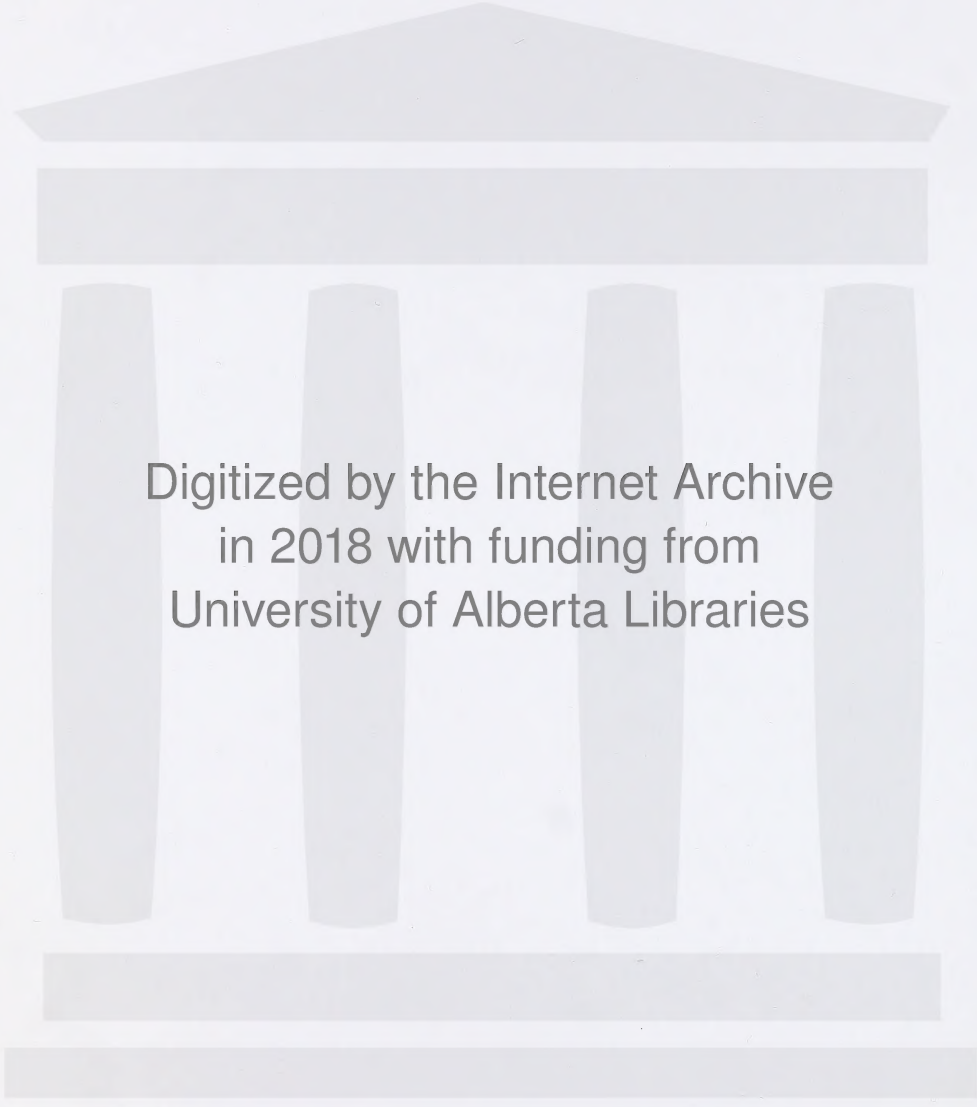


Bow River Basin State of the Watershed Summary 2010

Bow River Basin Council



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Overview

WELCOME! This State of the Watershed: Summary Booklet was created by the Bow River Basin Council as a companion to our new Web-based State of the Watershed (WSOW) tool. This booklet and the WSOW tool is intended to help water managers and users better understand the state of the Bow River watershed.

WHO IS THE BRBC?

The Bow River Basin Council (BRBC) is a collaborative, and multi-stakeholder, charitable organization, and a recognized Watershed Planning and Advisory Council (WPAC). Through its members, the BRBC creates and supports programs that encourage and advance the enjoyment, learning, and protection of the waters of the Bow River basin.

WHAT IS THE BRBC WSOW TOOL?

The BRBC WSOW tool is a new online, interactive and adaptive watershed management tool. It brings together current data and information on the basin's water quality and quantity, its landscape and biological community, and land use activities. It describes and assesses the current state of the watershed through its major sub-basins, identifies existing and emerging challenges and trends, and identifies gaps in data and knowledge. Through the WSOW tool, the BRBC is able to share recently available data, information and knowledge on the health and condition of the entire basin. It is also a website where people and organizations can become better informed and more actively involved in helping to manage the basin's water resources. We encourage you to learn more about the BRBC WSOW tool, and to share your water information, knowledge, stories, images and videos by going to: *www.brbc.ab.ca*

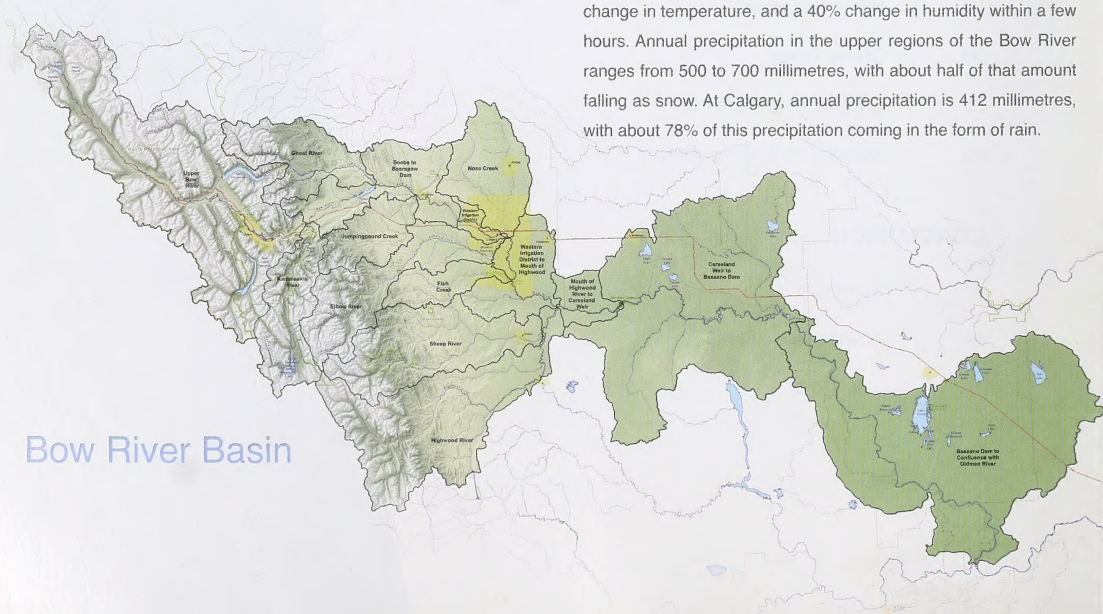
OVERVIEW OF THE BOW RIVER BASIN

Comprising about 25,000 square kilometres, the Bow River basin covers more than 4% of Alberta, and about 23% of the South Saskatchewan River drainage area in Alberta.

The headwaters of the basin are fed by the snow and glacial ice of the Rocky Mountains along the eastern side of the Continental Divide. The Bow River begins in Bow Lake and then flows in a southeasterly direction through a steep valley corridor in Banff National Park. Exiting Banff National Park, the river continues eastward and passes through the foothills onto the prairie, gradually widening and decreasing in gradient. It meanders through a wide, deep valley across the prairies to its confluence with the Oldman River. The meeting of the Bow and Oldman Rivers creates the South Saskatchewan River, the southwest tributary of the Saskatchewan-Nelson River system that eventually flows to the Hudson Bay, and then on to the Arctic and Atlantic Oceans.

On its journey from the Rocky Mountains through the foothills and prairies, the Bow River encounters many different landscapes and ecosystems. Riparian areas can be found along stream banks and floodplain of the river and its tributaries, as well as along the margins of wetlands and lakes. The variety of lakes is as diverse as any other region in Canada, ranging from cold alpine lakes to shallow prairie wetlands and irrigation reservoirs. Wetlands are found throughout the prairies, and are primarily located in the eastern regions of the basin. These areas provide habitat for a variety of mammals, birds, aquatic plants, benthic invertebrates, and fish.

The climate in the basin is typical of southern Alberta, with long, cold winters and short, warm summers. Dry westerly Chinook winds can produce dramatic mid-winter changes, as much as a 30°Celsius change in temperature, and a 40% change in humidity within a few hours. Annual precipitation in the upper regions of the Bow River ranges from 500 to 700 millimetres, with about half of that amount falling as snow. At Calgary, annual precipitation is 412 millimetres, with about 78% of this precipitation coming in the form of rain.



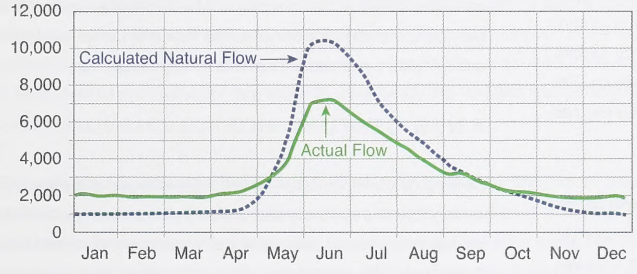
Bow River Basin

LET'S TAKE A CLOSER LOOK...

The Bow River is approximately 645 kilometres in length. It begins at Bow Lake, at an elevation of 1,920 metres above sea level, then drops 1,180 metres before joining with the Oldman River. In the mountains, the Bow River is relatively steep with gradients averaging 7 metres per kilometre. But, when the Bow becomes a prairie river, the gradient gradually reduces to 0.5 metres per kilometre at the confluence with the Oldman River.

With approximately 1.2 million people (34% of Alberta's population), and a population density of 41 residents per square kilometre, the Bow River basin is the most highly populated river basin in Alberta. In the last ten years, the population of the basin has grown by more than a quarter million people. The current population is 95% urban (22 urban municipalities, including the City of Calgary) with 4% residing in 12 rural or regional municipalities, and less than 1% residing in Aboriginal settlements. The hydrology of the Bow River is significantly affected by 13 dams, 4 weirs, and 8 reservoirs, making it the most managed or regulated river in Alberta.

Bow River at Calgary, Natural vs. Regulated Flows (cfs)
1960 - 1997



The Bow River is the largest tributary of the South Saskatchewan River, contributing nearly 43% to its 9.5 billion cubic metres of average annual flow. The Bow River receives most of its water from the progressive melting of spring and summer snow packs. Peak discharges generally occur during June, with minimum flows occurring in January. Flows decline over the late summer, fall and winter. Glacial melt contributes about 2.5% to the total annual flow during late summer and early fall, while flows during winter are heavily influenced by groundwater. However, for the extremely low flow year of 1970, upstream of Banff, glacial melt contributed to about 13% of the total annual flow, and the proportion of flow derived from glacial melt in August, 1970 was estimated at 56%. About 20% of the Bow River annual flow comes from shallow groundwater, and this source is particularly important for some tributaries. For example, groundwater can contribute up to three quarters of Jumpingpound Creek's annual flow.

Water quality varies along the Bow River, with more pronounced changes occurring downstream of the City of Calgary. As water moves along the river from west to east, there are increasing amounts of sediment, minerals, nutrients, and organic material found in the river. Some of these changes are natural, while others are due to treated wastewater effluent, stormwater, agricultural runoff, and human and industrial activities.

Ultimately, every person living in the Bow River basin bears some responsibility for its present and future state.

THE WATER TOWERS

The mountainous headwaters of the Bow River basin are often described as the water towers of the watershed. They are the source of most of the water in the river. Runoff originating in the water towers is determined by local precipitation, topography and climate, and is strongly influenced by forest cover. The majority of water in the Bow River comes from snowmelt, while the remainder of water comes from rain, groundwater and glacial melt.

DAMS AND RESERVOIRS

For nearly 100 years, the flow of the Bow River has been modified by dams, weirs and reservoirs. This has resulted in some ecological consequences, such as fragmented aquatic populations, and hydropeaking. However, operational changes to the storage reservoirs in the headwaters, and across the Bow River basin, has the potential to improve water management throughout the region, as well as contribute to its environmental health and economic growth.

GLACIERS

The contribution of glaciers to stream flow is mainly through runoff from the annual precipitation that falls on the glaciers. Glacier wastage or melt is the amount of water coming out of storage from the glacier ice. Although glacial melt has accelerated since the mid-1970s, it still represents a relatively small portion of the annual total runoff. There are several glaciers in the basin, including the Bow, Crowfoot, Hector, and Vulture Glaciers, and the Wapta and Waputik Icefields.

Basin History

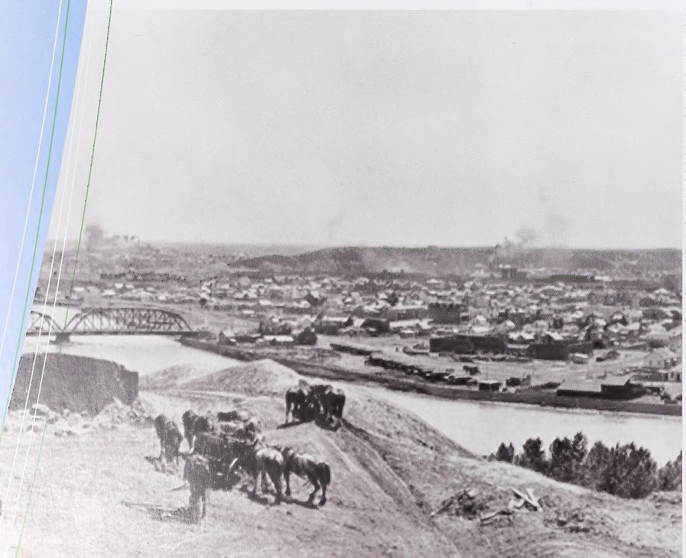
Ever wonder how the river came to be named the Bow? Bow refers to the reeds that grow along the banks of the Bow River. The Peigan name for the river is "Makhabn", meaning "river where bow reeds grow".

HISTORICAL OVERVIEW

The archaeology and history of the Bow River region is a uniquely fascinating story linked to the basin's rivers and watersheds. First Nations people have used the Bow River and its wetland and riparian regions for more than 10,000 years. The river and its tributaries not only supported local plants and wildlife, they provided a natural strategic base and transportation route, forcing human populations to remain within reasonable distances to water.

CHANGES IN TRADITIONAL WAYS | The evolving human history of the Bow River basin has reflected the changing values placed on its environment. The natural rhythm of aboriginal life in the Bow River valley began to falter early in the nineteenth century, with the arrival of European explorers, Hudson's Bay fur traders, church missionaries, and the devastating scourge of smallpox. The buffalo, which had sustained the First Nations for centuries, had begun to be hunted to near-extinction.

THE WILD, WILD WEST | From 1864 to 1874, with beaver pelts and buffalo hide still commanding high prices in Europe, American fur traders and veterans from the American Civil War flooded into southern Alberta. Trading bootleg whiskey for furs trapped by locals, the American opportunists spawned a decade of violence and chaos. Working from unruly trading posts with names like Fort Whoop-Up and Slide-Out, they presided over the near collapse of the First Nations culture, virtually unchallenged by any system of law and order.



Source: Glenbow Museum Archives NA5150-1

FORT CALGARY | In 1875, with the Canadian government fearing further American domination, the "F" Troop of the North West Mounted Police was sent from Fort MacLeod to stem the insidious whiskey trade. Over the course of six weeks, Inspector E. A. Brisebois and fifty of his men built a mud-chinked, rough log fort at the confluence of the Bow and Elbow Rivers. Named Fort Calgary, the primitive palisade became the first building of what is now the City of Calgary.

STEEL RAILS AND IRON HORSES | When the Bow River valley was selected as the route for the Canadian Pacific Railway in the late 1880s, the railway established the first permanent European occupation in the headwaters of the Bow River.

ROCKY MOUNTAIN HOT SPOT | Canada's first national park, Rocky Mountains Park, was established in 1885. Renamed as Banff National Park in 1930, it remains a popular tourist destination. The pleasures of the park's sulphurous, health restoring natural hot springs, just a few kilometres up the mountain from the Bow, were no secret to the First Nations people who lived in the region. Within two years, the springs were attracting their first European visitors, and by 1886, a rudimentary bathhouse was constructed.

A NEW CENTURY SIGNALS CHANGE

Development and population growth in the early part of the twentieth century followed the rivers and streams, as the flowing waterways provided food, water, and a path that was easy to find and follow. Once trails and settlements were established, the waterways became a route to transport cargo and merchandise. The Bow and other rivers in southern Alberta provided a lifeline through the region, with towns and cities growing beside them. In the early twentieth century, railroads were built to follow the routes of the major rivers, followed by roadways to support the new technology known as the "horseless carriage".

Some of the first structures constructed on the Bow River were for irrigation and drinking water needs. These included the Little Bow Weir (1910), the Horseshoe Dam (1911), the Kananaskis-Seebe Dam (1913), and the Bassano Dam (1914). The first significant structure, the Ghost Dam, was completed in 1929. This was followed by the Glenmore, Lake Minnewanka, Upper Kananaskis, Barrier, Spray, Bearspaw and Lower Kananaskis structures.

THE NEW MILLENNIUM

Today, the Bow River basin is the most highly populated and regulated river in Alberta, and water has become the most significant resource issue for balancing environmental management practices with regional economic development.

WATER ALLOCATION AND USE

Water management, regulation and governance in the Bow River basin have a long and inter-related history involving many different public and private stakeholders. This history is a reflection of the region's development, and of ongoing changes to the supply and demand for water. Economic and population growth, irrigation, recreation and other uses for water have grown significantly. Portions of southern Alberta have been granted water allocations to such an extent that Alberta Environment no longer accepts new applications for water allocations in the Bow, Oldman and South Saskatchewan River sub-basins.

It has been said that continued economic growth can only be achieved at the expense of the environment. However, sustainable management of the basin's water resources does not have to imply reduced economic growth or environmental degradation. The adoption of new water management opportunities such as water allocation transfers, water insurance policies for junior licenses, drought and flood protection, conservation, water reuse, and re-regulating the volume and timing of river storage and flow can help to better match water demand with supply.

In the upper sub-basins of the Bow River, the average annual flow is almost always adequate for the many licensees and environmental requirements. However, in the lower sub-basins during the summer and early fall of some years, the flow is not always adequate to meet desired environmental requirements, plus satisfy the demand from all licensed diversions.

There are two ways to respond to flows that do not meet human demand and the needs of the environment. The first is to reduce demand through conservation, efficiency, and productivity of existing and future water use. The second is to store water during high flow periods, for later release during low flow periods, while remembering that high flows also have an important role in maintaining healthy aquatic ecosystems.

WATER ALLOCATION | In 2010, total annual surface and groundwater allocations in the Bow River basin totaled 2,801 million cubic metres. Agricultural uses and irrigation accounted for about 71% of total allocations or 1,980 million cubic metres. Municipalities accounted for most of the remaining allocations, totaling about 510 million cubic metres, or 18% of total allocations. The balance of water allocations is for water, fish, wildlife and habitat management (7%), industrial and commercial uses (2%), and other uses (2% of total allocations). At this same time, known groundwater allocations only account for about 1.3% of total allocations, or 36.6 million cubic metres of water.

WATER USE | Not all the water that is allocated is consumed. With respect to actual use, the exact volumes diverted and used are not precisely known because not all water users submit water use reports to Alberta Environment. Based on 2005 compiled data, it is estimated that 1,124 million cubic metres of water was actually used (amount of water diverted less return flow) in the Bow River basin. This comprised about 35% of the estimated water use in Alberta in 2005. Agriculture and irrigation accounted for about 89% of estimated use in the Bow River basin, while municipalities comprised about 5% of estimated water use, and commercial and industrial sectors each accounted for another 2% of estimated water use. In 2005, the total estimated licensed water use for the petroleum sector was about 1.5 million cubic metres.

WATER USE

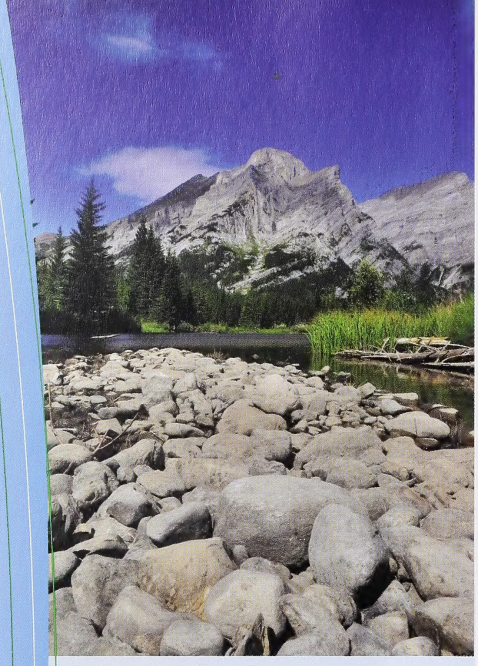
The 1,124 million cubic metres of water estimated to have been used in the Bow River basin in 2005 would weigh approximately 1.1 trillion kilograms (at an average temperature of 4°C), and would fill the equivalent of 450,000 Olympic sized swimming pools. That's a LOT of water!

ALLOCATION AND NATURAL FLOW

In 2008, between 60% to 70% of the average annual natural flow of the Bow River basin was allocated. However, allocations are not a direct measure of actual use. Rather, they represent the maximum amount of water that can be used under the terms of licenses issued, when and if sufficient water is available in the quantities licensed in a given year.

APPORTIONMENT AGREEMENT

Alberta has agreements with Saskatchewan, Manitoba and Canada that guarantees a certain amount and quality of water will flow across the border. To meet the apportionment requirement in southern Alberta, the province must deliver 50% of the annual natural flow of the South Saskatchewan River. The Oldman Dam and Glennifer Lake reservoirs help Alberta to meet its apportionment requirements, while winter flows from hydroelectric operations in the Bow River basin contribute to apportionment flows on an annual basis.



ALBERTA CONSERVATION INFORMATION MANAGEMENT SYSTEM

One of more than 80 centers in an international Natural Heritage Network established in 1996, the ACIMS provides biodiversity information necessary for making informed decisions concerning conservation, natural resource management, and development planning. The ACIMS collects, updates, analyzes and disseminates information about the location, condition, and trends of selected natural plant communities.

Source (top and bottom): Mueller

What is a Watershed?

The Bow River basin is a watershed. It is made of several smaller watersheds called sub-basins. The term 'watershed' refers to all the land that feeds water through tributaries to the Bow River.

DEFINITION OF A WATERSHED

A watershed can be defined as an extent or area of land that catches precipitation and drains it into a body of water such as a wetland, stream, lake, or ocean. A watershed such as the Bow River basin is made up of a number of small watersheds that contribute water to the receiving waters. Each watershed is separated topographically from adjacent basins by a geographical barrier such as a ridge, hill or mountain, known as a water divide.

Other terms that are used to describe a watershed are drainage basin, catchment basin or area, and river basin. However, a watershed is much more that just an area on a map. A watershed comprises many complex processes and their interactions, such as:

- Water sources (precipitation, glacial melt, surface runoff, groundwater)
- Flowing waters (rivers and streams)
- Lakes and wetlands
- Upland areas, land cover and land use practices

WHY IS A HEALTHY WATERSHED IMPORTANT?

SUPPLIES DRINKING WATER | Humans are especially reliant on clean drinking water and need a reliable water source. Watersheds provide the water that enters our homes from wells, or from networks of pipes from municipal water treatment plants.

PROVIDES A PLACE TO LIVE | Watersheds are like huge neighborhoods within which all living things share water and where all wildlife, whether bird, butterfly, frog, bear or bat, need habitat. Water is a vital part of the basin's habitat, providing food, shelter and space for all species of flora and fauna.

ALLOWS FARMERS TO PRODUCE GOODS | Farmers and ranchers across the Bow River basin draw on water from the Bow River and its tributaries to irrigate crops for food, to feed livestock, and to maintain their agricultural operations.

SUPPORTS BUSINESS | Most industries use water from watersheds in manufacturing processes, or for cooling and cleaning. Many commercial operations directly depend on water from the Bow River basin's streams, lakes, and rivers.

ENABLES RECREATION AND NATURAL BEAUTY | Watersheds provide the lakes, streams, riparian areas and wetlands we use for fishing, boating, swimming, and relaxing. Scenic waterways, mountain terrain and prairie grasslands are among the natural features in our landscape that give us cause to reflect, admire and share in the beauty of our environment.

Flora and Fauna

Plants, fish and wildlife are part of the important balance of biotic and non-biotic components of a healthy watershed. They are integral components of the watershed, connecting with the physical environment in the uplands, and contributing to the biodiversity of riparian and wetland areas. Geomorphic processes are very important for channel health and for maintaining biodiversity.

The abundance, diversity and geographic extent of wildlife and aquatic plants are largely dependent on the quality and quantity of riparian and wetland areas, as well as water quality and water availability.

While dams, weirs and reservoirs have created new wildlife habitat within the basin, water control structures can present some challenges to ecosystem integrity by creating barriers for movement, altering natural flow patterns, and modifying water temperatures.

PLANTS

Trees and shrubs carry out many important functions in natural ecosystems. Most importantly, through photosynthesis, plants convert energy from the sun into usable food energy for other forms of life.

Throughout the watershed, a rich variety of vegetation communities serve as water filters, promote bank stabilization, and help to support many unique species and ecosystems.

Progressing from permanent ice cover and alpine tundra in the highest mountain elevations, there is a transition to sub-alpine fir and spruce forests on the lower mountain slopes. The montane areas in the lower valleys and foothills of the Rocky Mountains reflect a rich mix of deciduous and coniferous forests.

A change from foothills parkland to foothills fescue occurs just west of Calgary. Farther east, the mixed grass environment becomes dry mixed grass prairie, and due to water availability, cottonwood and poplar trees are typically found in riparian areas.

Abundant and mature cottonwood groves occur in the grassland river valleys, and were likely established as seedlings during a few major recruitment (flood) events, such as in 1915 and 1932. As stream flows have stabilized, due to dams and drier climatic conditions, fewer of these trees have been recruited.

Often mistaken for wildflowers, invasive plants are spreading through the basin. Invasive alien plants are species introduced deliberately or unintentionally outside of their natural habitats. In their new environment, free from their natural 'enemies', non-native plants have an advantage that allows them to out compete native plants and agricultural crops for space, moisture and nutrients. As native plants are replaced by invasive species, habitats change and biodiversity declines.

Algae and other aquatic plants generally increase downstream of Calgary, due to municipal wastewater effluent, stormwater and agricultural runoff.

WETLANDS

Wetlands are defined as land having water at, near, or above the surface of the land. Wetland is also land which is saturated with water long enough to promote wetland or aquatic processes, as indicated by poorly drained soils, hydrophytic vegetation, and various kinds of biological activity adapted to the wet environment. Wetlands are nature's kidneys, performing a natural cleansing function by filtering sediments, excess nutrients and pollutants. They provide a rich habitat for plants, insects, and birds, and help with regulation of river flows, flood and erosion control, recreation, and inspiration. Some municipalities within the basin have a wetland policy to assess applications for development, including a restoration and compensation guide for avoiding, minimizing and mitigating wetland loss.

WHERE DOES THE WATER IN THE BOW RIVER BASIN COME FROM?

Most of the water in the Bow River basin comes from the Rocky Mountains and foothills west of Calgary. The mountains force moisture-laden air to rise, and as the rising air cools, moisture condenses and falls as rain or snow. Some of this moisture returns to the atmosphere, and some flows downhill on the surface of the watershed to streams, lakes and rivers, or enters the ground. Surface and groundwater are connected, and both require careful management.

Everything we do on the land and in the water affects the water in the basin, and, as such, will impact all the organisms and communities living downstream.

WILDLIFE

The Bow River basin has some of the best watchable wildlife opportunities in the province. The diversity of wildlife surpasses that in many other jurisdictions and runs the gamut from ants and pronghorn to walleye and whiskey jacks. Many species are well known and well appreciated for a multitude of benefits. Others are seldom seen and not well understood, placing them at risk for survival.

BIODIVERSITY

Biodiversity, the variety of life on earth, is essential to sustaining the living networks and systems that provide all of us with health, wealth, food, fuel, and other ecosystem services we depend on. Managing natural resources requires timely and trustworthy information about the health of the environment. The Alberta Biodiversity Monitoring Institute conducts world-class biodiversity monitoring of more than 2,000 species and habitats to support scientific knowledge and decision-making about provincial biodiversity.

CONSERVATION

Species at risk are the most vulnerable components of Alberta's biodiversity, and the integrity of Alberta's ecosystems is dependent on their continued presence. We encourage you to learn more about Alberta's Strategy for the Management of Species at Risk. Alberta's species at risk program is an integral component of a national process of working together to conserve and recover species at risk in all jurisdictions of Canada. Go to *www.srd.alberta.ca* for more information.

WILDLIFE

Few places in the world have as great a variety of wildlife as Alberta, and the Bow River basin is a prime example of that diversity. Mammals, birds, amphibians and reptiles that reside in the Bow River basin all have an important part to play in its ecosystems.

MAMMALS | The presence of mammals in an ecosystem is essential to preserve balance. The great variety of terrain and plant communities within the Bow River basin provides a diverse habitat for both large and small mammals.

Bighorn sheep, elk, moose, wolf, cougar and bear are found in the upper mountainous regions. In the prairie region, common mammals include pronghorn, deer, coyotes, jackrabbits, and ground squirrels.

While many species of mammals in the basin have adapted to human influences and changing environments, others have decreased in number or disappeared completely. Mammals at risk include the swift fox, and recently, the grizzly bear.

BIRDS | Birds are important to watersheds because they eat many insects and small animals considered to be pests; they help pollinate various species of plants and flowers; and, eat the seeds of many weeds.

More than 200 species of birds can be found throughout the Bow River basin, including falcons and hawks, eagles, grouse, owls, pelicans, and other waterfowl. Some of these species use the region as a stopover during fall and spring migrations, others nest in summer, while others live here all year round. The burrowing owl is one species that is no longer found in the basin.

AMPHIBIANS | Amphibians are valuable members of watershed ecosystems because they can eat thousands of insects over one summer, and are an important food source for many fish and birds. They are sensitive to changes in both water quality and adjacent land use practices, so their populations can also serve as indicators of overall environmental health and quality. Species found in the basin include the Boreal Chorus Frog, Columbia Spotted Frog, Northern Leopard Frog, Wood Frog, Long-toed Salamander, and Tiger Salamander.

Many of the Bow River basin region's amphibian species are being monitored under two long-term programs: the Alberta Volunteer Amphibian Monitoring Program, and the Researching Amphibian Numbers in Alberta program. Learn more at *www.srd.alberta.ca*

REPTILES | Several species of reptiles are found in the Bow River basin including the Prairie Rattlesnake, Red-sided Garter snake, Plains Garter Snake, Wandering Garter Snake, Bull Snake, and Western Hog-Nosed Snake.

Dangerous and misunderstood, the rattlesnake is quite helpful in keeping down the populations of mice and voles in a watershed. Rattlesnakes in particular are drawn to the heat of road pavement at night, making them more vulnerable to being killed by traffic. Garter snakes are harmless, except to the amphibians, small fish, insects, worms and rodents that make up their diet.

FISH

Information on fish habitat in the Bow River is extensive. Fly fishing opportunities abound, with some areas considered to be an angler's paradise. The Bow's spectacular foothill and mountain scenery, coupled with abundant rainbow and brown trout, draw fly fishermen from around the world.

FISH SPECIES | The Bow River basin provides habitat for 40 different fish species. While many of Alberta's 18 common sport fish species are known to anglers, the vast majority of fish found in the province are lesser known non-sport species such as minnows and suckers. In fact, of the 65 fish species currently found in the province of Alberta, 45 species are of the non-sport variety.

Mountain whitefish remains the most common native sport coldwater fish species throughout the Bow River. They overwinter in the Bow and lower Highwood and Sheep Rivers, but make their way to the Upper Sheep and Highwood Rivers to spawn.

Generally, introduced species of rainbow, brown and brook trout have largely replaced native species. Brown trout spawn within the City of Calgary and the lower Elbow River. Rainbow trout spawn in the Bow River near Bearspaw, in the Sheep and Highwood Rivers, and in smaller tributaries. While stocking of some species (brook trout in 1911) was done purposefully to improve angling, other introductions were accidental.

Populations of the native cutthroat and bull trout once ranged from the extreme headwaters feeding Bow Lake to the mainstem downstream of Calgary, but they have been substantially reduced. Currently, these two species can be found throughout several sub-basin tributaries, but in the mainstem they are only present within the mountainous headwaters of Banff National Park.

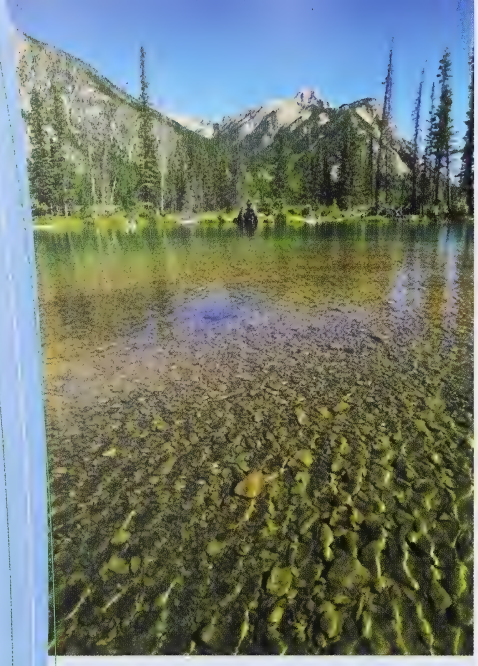
More than half the length of the Bow River, from its headwaters to the Carseland Weir, is cold water aquatic habitat, suitable for fish species like rainbow and bull trout that require cold, clean, fast moving water. However, between the Carseland Weir and the Bassano Dam, the Bow River gradually changes to cool water aquatic habitat, suitable for sturgeon, pike and walleye. These species can tolerate the warmer, slower and more turbid water found in the lower sub-basins.

ENVIRONMENTAL CHALLENGES | Habitat loss and modification, over-fishing and non-native fish introductions are some of the pressures facing native fish populations. Other pressures include:

- The Bassano Dam, which serves to divert water for irrigation, reduces the flow in the river, impacting fish habitat. With lower flows, the temperature of the water is able to rise more quickly during the summer, and temperatures can exceed the tolerance of some of the cool water fish species.
- Some of the dams and weirs within the basin present barriers to fish movement, impacting both native and introduced species.
- During times of low flows, the warm, shallow, nutrient-rich waters can occasionally experience low dissolved oxygen concentrations and pH and temperature fluctuations. Although water quality has significantly improved downstream of Calgary, the periodic occurrence of these conditions can stress fish.

While dams in the basin can present barriers to fish movement, the additional flow in the Bow during the winter months released by upstream dams contributes to the excellent rainbow and brown trout fishing in the region. In addition, careful flow and water quality management on the lower Highwood-Sheep River system is also essential to sustaining the health of sport fishery in the region.

BOW HABITAT STATION | The Bow Habitat Station offers a unique setting to learn about and explore the natural environment of Alberta's waterways. It includes one of the largest enclosed trout hatcheries in North America - the Sam Livingston Fish Hatchery - raising as many as 3 million fish annually for stocking Alberta's waters. It also offers an interpretive Wetland Centre, providing opportunities to discover Alberta's wetlands, to take a stroll along scenic interpretive trails, and to observe the plants and animals that use wetlands as their home.



BASIN WATER QUALITY

In general, surface runoff in the Bow River basin during the spring and early summer increases total suspended solids and turbidity, which is related to other water quality issues. During the base flow period, the contributions by groundwater becomes more prevalent and can influence nitrogen, total dissolved solids concentration, and other water quality variables. Two additional contributing factors to the region's water quality are modifications in river flows (by reservoir operations and other diversions), and agricultural and municipal storm and wastewater return flows.

State of the Watershed

A State of the Watershed Report is a compilation and scientific interpretation of available watershed data and information, leading to conclusions about the condition of that watershed. The BRBC completed State of the Watershed reports in 1994 and 2005 to understand the condition and pressures in the Bow River basin. These reports were important first steps in developing strategies to improve and protect the watershed.

PURPOSE OF THIS REPORT

Often the first question asked when discussing local issues and opportunities related to a water body is "What is the current condition of my lake or stream?" This inevitably leads to additional questions, such as "How does this compare to conditions in the past? What factors are contributing to the current condition? These questions are essentially asking "What is the state of my watershed?" To answer this question, one must conduct an overall assessment of the watershed.

A State of the Watershed assessment should contribute to:

- an understanding of how natural features and processes influence watershed conditions;
- insights into the linkages between watershed health, and land and water uses;
- identification of watershed risks, and an evaluation of the individual and cumulative effects of water and land management practices; and
- the validation of public perceptions relating to stressors and conditions within the watershed.

Documenting watershed assessment findings in a State of the Watershed Report may substantiate real and perceived concerns, identify information gaps, and make recommendations on the collection of additional data that is not currently available. The report can function as a catalyst to establishing a new community-based watershed group. It can provide an already established group with the information needed to recognize watershed risks, problem areas and activities; set priorities, develop specific preservation and restoration goals; target rehabilitation and protection activities; and develop implementation plans for protecting and improving watershed health. Because the State of the Watershed report is a detailed record of current conditions and characteristics of a watershed, it also has the potential to serve as a benchmark to measure future environmental change, and help in developing monitoring programs to assess the progress of stewardship efforts.

The process of drafting a State of the Watershed report may also provide a number of additional or unanticipated benefits. The assessment process not only brings together relevant information, it brings together people who will become instrumental in the development and implementation of subsequent plans and activities. The process helps to engage knowledgeable people, locate valuable information sources, and perhaps even alert stakeholders to interests or issues that may not originally have been considered by the group.

INDICATORS

Healthy watersheds consist of multiple components and perform many functions that keep the ecosystem in balance. The broad and complex nature of interactions within these systems makes it nearly impossible to measure watershed health directly, or to measure every component of that ecosystem. As such, a set of defined and easily measurable attributes (State of the Watershed Indicators) that reflect the conditions and dynamics of the broader ecosystem can provide information about the conditions and trends within a watershed. Indicators can be a measure of a single parameter, also known as a metric (e.g., water temperature, dissolved oxygen concentration), or an index that incorporates a number of metrics (e.g., the Bow River Surface Water Quality Index or the River Flow Quantity Index).

The BRBC has carefully selected an initial set of indicators to illustrate changes in the basin's condition and stresses over time, and to measure the organization's progress towards meeting the objectives and outcomes of its watershed management plan.

The Bow State of the Watershed indicators (illustrated in the sidebar) have been categorized by the watershed element they represent (i.e., water quantity, water quality, landscape and biological community). A range of values has been established to illustrate and report on the condition of each indicator, from NATURAL to GOOD to FAIR to CAUTIONARY. In general, these conditions have been color-coded as follows:

NATURAL (Blue Icon) - The conditions for this indicator are considered to be in a natural state.

GOOD (Green Icon) - Cumulative impacts are considered to be minimal, and the indicator is in a desired state.

FAIR (Yellow Icon) - Conditions are shifting away from a desired state, but have not yet reached a cautionary threshold.

CAUTIONARY (Red Icon) - Conditions have deteriorated such that the indicator is in an undesired state, and is no longer within desired threshold levels.

The environmental implications and corresponding management actions differ for each of the above conditions. For example, management actions may include reductions in wastewater loading to meet quality triggers or limits, implementation of best management practices to address non-point source problem areas, or some combination of actions depending on the situation.

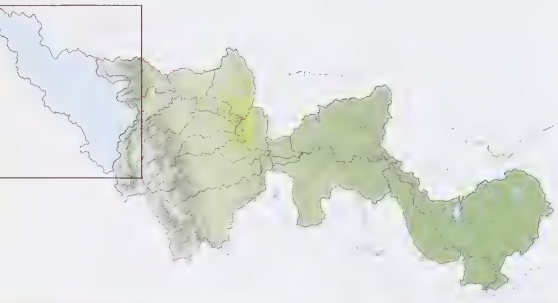
When the recorded value for an indicator changes such that the health of the watershed has been improved, the status associated with that indicator might be upgraded, resulting in the icon for that indicator changing from CAUTIONARY (red icon) to GOOD (green icon). The goal is to establish scientifically based thresholds for each of these watershed indicators, as well as linking each indicator with as much relevant and recent data as is possible. Over the long term, the indicators will form part of an adaptive management reporting system based on the most current data available. Adaptive management is a proactive process that optimizes decision-making, and aims to improve management and reduce uncertainty through performance assessment.

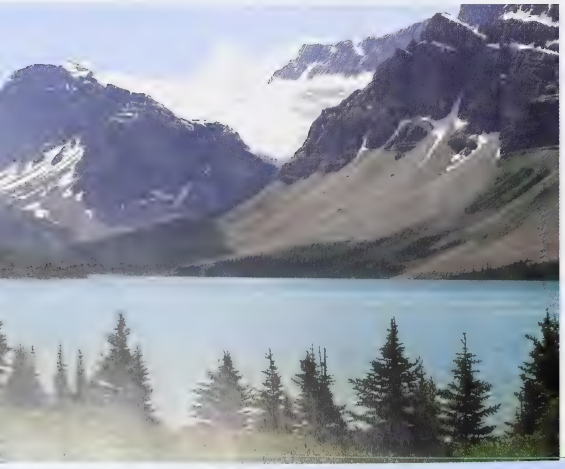
OUR SUB-BASINS

Upper Bow River

SNAPSHOT

The indicators for the Seebe to Bearspaw sub-basin range from NATURAL to GOOD. For this sub-basin, the River Flow Quantity Index is measured at three different locations. Bow River at Lake Louise and Bow River at Banff are within NATURAL levels. The exception is the River Flow Quantity Index value for Spray River at Banff, which has maintained a relatively consistent, albeit low, river flow value since being managed in 1952. The most relevant issues in the sub-basin are protection of the headwaters, the impacts of climate change on glaciers, and managing the impacts of increasing population, tourism and recreation.





THIS IS WHERE THE STORY OF THE BOW RIVER BASIN BEGINS, in the water towers and the headwaters. The Upper Bow River sub-basin consists of a number of highly variable microclimates that can change rapidly according to sunlight, slope, elevation, and wind conditions. As westerly flows of air move across the western part of the sub-basin and the Rocky Mountains, they lose moisture, producing a considerable amount of precipitation. The Rockies are also affected by periodic easterly air flows that can produce heavy spring snowfalls that enhance the winter snow pack. The annual precipitation at higher elevations can be more than 600 millimetres, while in the eastern prairies it is about half that amount.

PROFILE

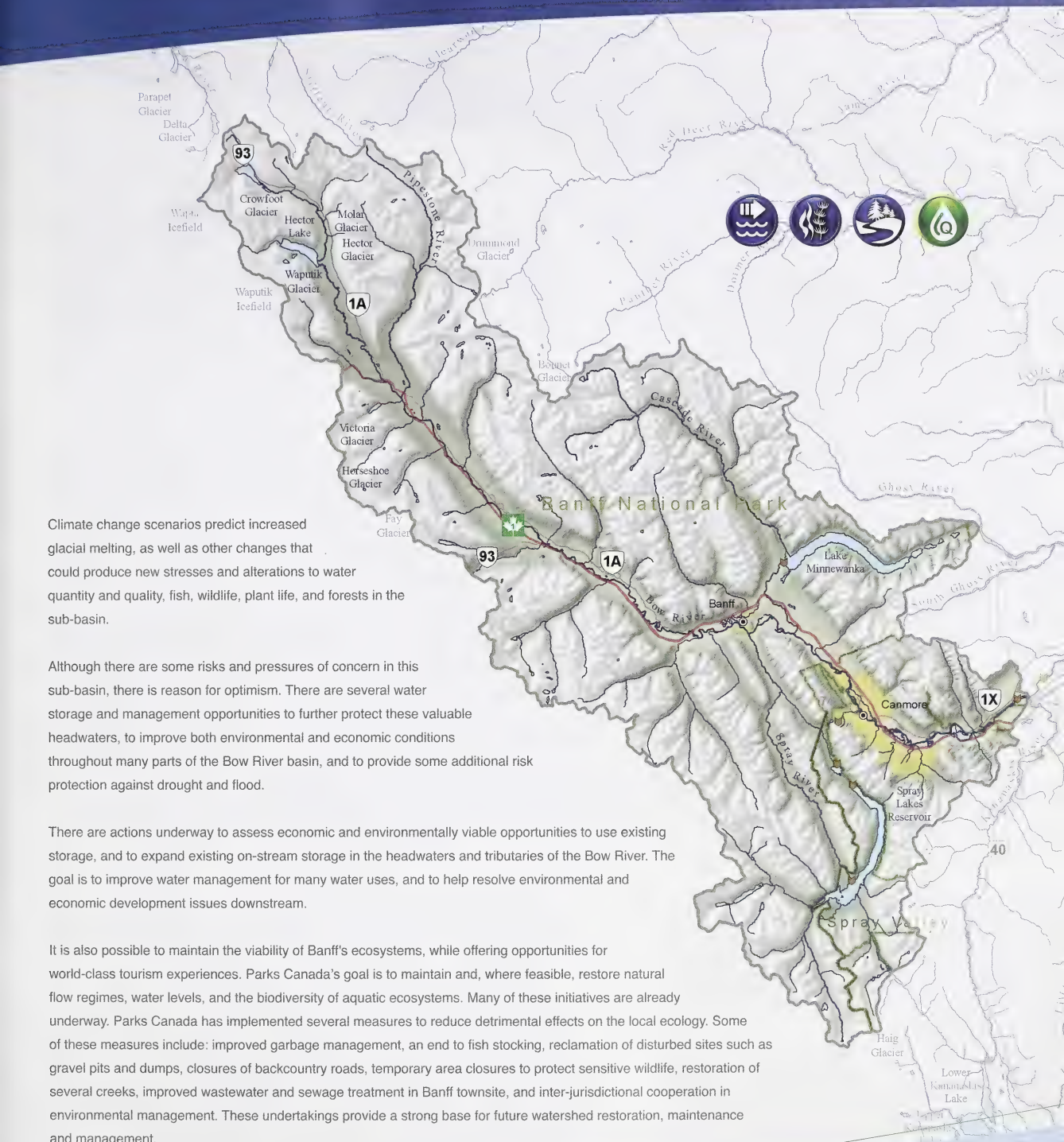
The Upper Bow River sub-basin extends from above Bow Lake, southeast to the Banff Park boundary, then east past Canmore to Seebe, at the junction of the Trans Canada Highway 1 and Highway 40. Major population centers in the sub-basin include Lake Louise, Banff, and Canmore. It is bordered by the Ghost River and Seebe to Bearspaw sub-basins to the east, and the Kananaskis River sub-basin to the southeast. There are several lakes throughout the region including the Bow, Hector, Herbert, Moraine, Minnewanka, Spray, and Louise (among others).

In addition to the Bow River, there are a number of rivers in the sub-basin including the Pipestone, Cascade, and Spray. There are hundreds of creeks, such as Johnston, Red Earth, Forty Mile, Brewster, Baker, Three Sisters, as well as many other smaller creeks and streams.

CHALLENGES AND RESPONSES

The protection of the Bow River headwaters is critical to the health and economic development of all downstream communities. Unlike sub-basins downstream, water use is not a major concern in this sub-basin. Flows are adequate and provide the in-stream flow needs for water quality, fish habitat, riparian vegetation and channel maintenance. While changes to the land are not as great as in more highly populated downstream sub-basins, some human activities are beginning to impact water quality and aquatic ecosystems. An increasing number of residents and park visitors contribute to air pollution, sewage, solid waste, and the demand for potable water. Transportation corridors through the park can fragment the landscape and block movement of wildlife.

Of the twenty species of fish in the Bow valley, ten are non-native. Ongoing research into native fish, specifically bull and cutthroat trout, will help define their current status and identify where reintroductions may be possible.



Climate change scenarios predict increased glacial melting, as well as other changes that could produce new stresses and alterations to water quantity and quality, fish, wildlife, plant life, and forests in the sub-basin.

Although there are some risks and pressures of concern in this sub-basin, there is reason for optimism. There are several water storage and management opportunities to further protect these valuable headwaters, to improve both environmental and economic conditions throughout many parts of the Bow River basin, and to provide some additional risk protection against drought and flood.

There are actions underway to assess economic and environmentally viable opportunities to use existing storage, and to expand existing on-stream storage in the headwaters and tributaries of the Bow River. The goal is to improve water management for many water uses, and to help resolve environmental and economic development issues downstream.

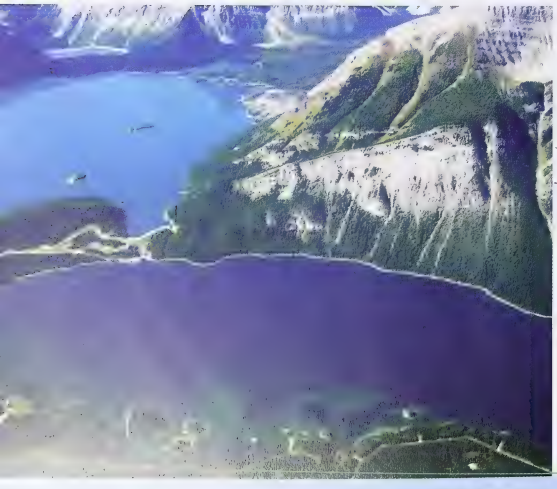
It is also possible to maintain the viability of Banff's ecosystems, while offering opportunities for world-class tourism experiences. Parks Canada's goal is to maintain and, where feasible, restore natural flow regimes, water levels, and the biodiversity of aquatic ecosystems. Many of these initiatives are already underway. Parks Canada has implemented several measures to reduce detrimental effects on the local ecology. Some of these measures include: improved garbage management, an end to fish stocking, reclamation of disturbed sites such as gravel pits and dumps, closures of backcountry roads, temporary area closures to protect sensitive wildlife, restoration of several creeks, improved wastewater and sewage treatment in Banff townsite, and inter-jurisdictional cooperation in environmental management. These undertakings provide a strong base for future watershed restoration, maintenance and management.

To discover more about this sub-basin, go to http://wsow.brbc.ab.ca

Kananaskis River

SNAPSHOT

While the annual River Flow Quantity Index indicator for the Kananaskis River (above Pocaterra Creek) is generally rated as NATURAL, there can be significant variations in river flow during certain periods of the day and season. This variation in river flow levels can result in periods where the indicator is considered to be CAUTIONARY, or diminished from natural levels. The most relevant issues in the sub-basin are protection of source waters, effects of hydro-generation, mountain pine beetle infestations, aging forests, and the impact of increasing tourism and recreation.



Source: Kevin Lenz, wikipedia.com

The name Kananaskis was chosen 150 years ago to name the lakes, valley, and river visited by Captain John Palliser on his expedition through the area. The name comes from the Cree 'Kin-e-a-kis' and is said to be the name of a warrior who survived an axe blow to the head. Archaeological evidence of human use in this sub-basin goes back more than 8,000 years. The Stoney-Nakoda, Siksika, Blood, and Kootenai First Nations all have deep connections to this land.

PROFILE

The Kananaskis sub-basin extends from Seebe southward past the Upper and Lower Kananaskis Lakes, and eastward from Peter Lougheed and Spray Valley Provincial Parks to the edge of the Kananaskis Improvement District and the headwaters of the Elbow River. There are no significant or permanent population centers in the sub-basin. It is bordered by the Upper Bow River sub-basin to the west, the Seebe-Bearspaw sub-basin to the north, the Highwood sub-basin to the south, and the Sheep, Elbow and Jumpingpound sub-basins to the east.

It drains an area of almost 1,000 square kilometres, including some forest reserve and several provincial park areas such as the Spray Valley, Bow Valley, Peter Lougheed and Elbow Sheep Wildland Parks. These park areas are known as Kananaskis Country.

There are a number of lakes located in the sub-basin, including the spectacular Upper and Lower Kananaskis Lakes, and the Barrier Lake Reservoir. While the Bow River does not directly flow through the sub-basin, there are a number of other rivers in the region including the Upper Kananaskis and Kananaskis Rivers. There are hundreds of creeks and streams throughout the sub-basin, including Brewster, Boulton, Pocaterra, Galatea, Evan-Thomas, Wasootch, Marmot, Lorette, and Stony.

The Upper and Lower Kananaskis Lakes have a low concentration of dissolved solids and water alkalinity compared to other lakes in Alberta. Both lakes are nearly saturated with oxygen down to approximately 50 metres, and there is no evidence of dramatic changes to dissolved oxygen below this depth. Both lakes are relatively low in nutrients.

The Kananaskis River valley provides important wildlife habitat and movement corridors for a variety of large mammals in the Bow Valley Provincial and Banff National Parks. Elk, deer, mountain goats, bighorn sheep, and black bears are common in the watershed, with smaller populations of moose, grizzly bear and wolf. Fish species in the Kananaskis River include brook, brown, bull and cutthroat trout, mountain whitefish and longnose suckers.

CHALLENGES AND RESPONSES

A substantial reduction in fish habitat and production, as well as diminished recreational activities, has been caused by variations in daily river flows on the Kananaskis River, due to the demands of hydro-electricity operations. These operations encompass three reservoirs and two regions of the river that run through pristine mountain terrain, two provincial parks, and other protected areas.

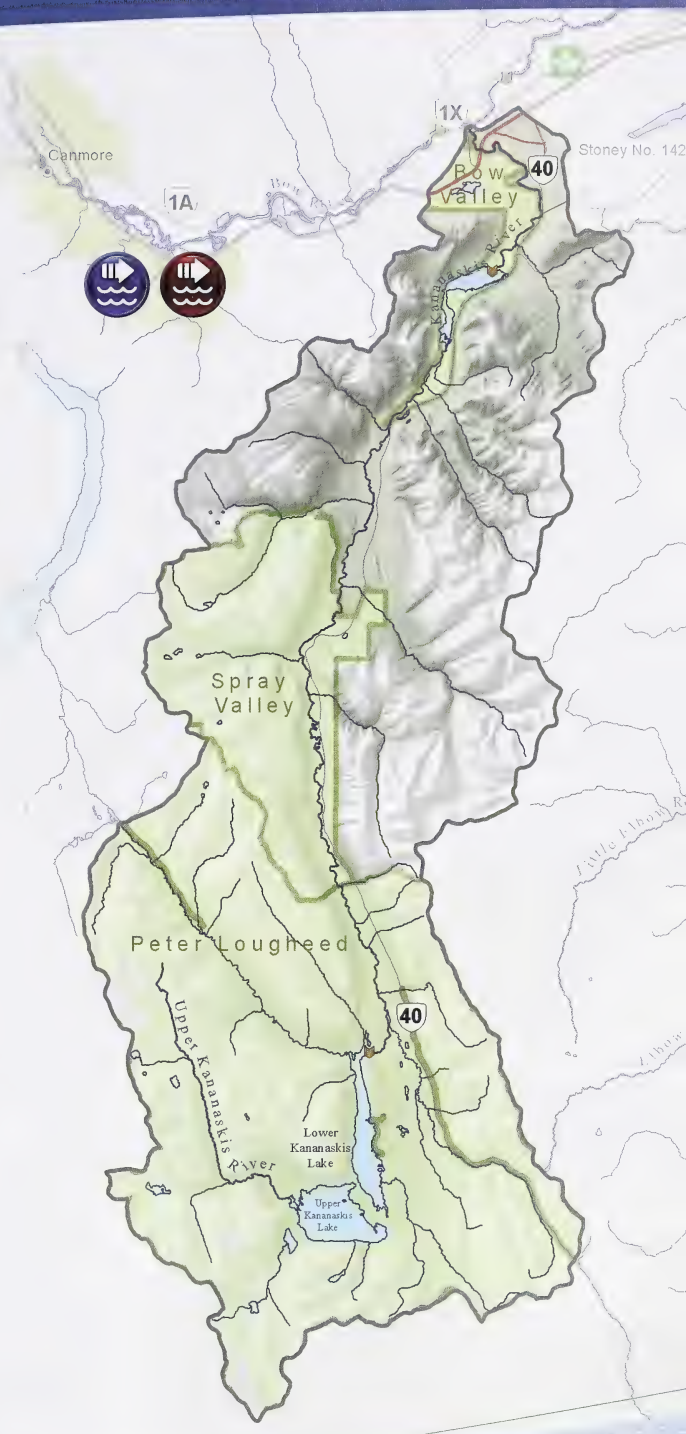
Historically, there have been some unintended consequences of operating the three Kananaskis power plants in order to generate power during peak usage periods. For example, the water level in the lakes varies dramatically during the year. The Kananaskis River flow is reduced overnight (when electricity demand is lower) to allow the reservoirs to refill. Most of the river does not actually dry up overnight, since groundwater inflows and tributary runoff feeds into the main stem of the Kananaskis. However, fish habitat and production in both the lakes and the river have been dramatically impacted for several decades.

Changing the operations of the hydro assets on the Kananaskis River system presents one of the most promising environmental and economic optimization opportunities in the basin. There is the prospect of re-establishing world-class trout fisheries, as well as creating additional recreational whitewater kayaking and rafting opportunities to match the region's spectacular scenery.

Nearly two thirds of the multi-use area envisioned by Peter Lougheed is now protected as a park, ecological reserve, or recreation area. The needs of industry, ranching, and tourism are still balanced with the mandate to preserve the animals, plants, and processes that keep the ecosystem of Kananaskis Country healthy.

Management of Kananaskis Country today also includes dealing with the large increase in outdoor recreational needs associated with rapid urban growth, aging forests, and running ski activities at the Nakiska Resort.

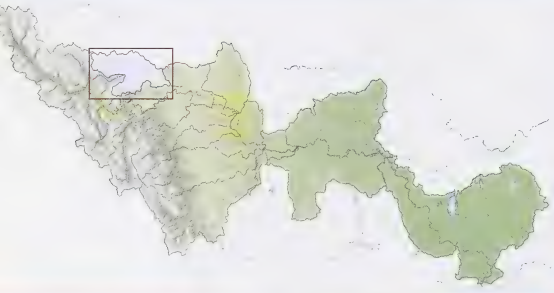
According to Alberta Parks staff, the number of visitors to the area has nearly doubled in recent years. Future development will be directed by the Kananaskis Country Recreation Policy, which outlines specific guidelines that are to be followed if any type of infrastructure is introduced in the area.



Ghost River

SNAPSHOT

The indicators for the Ghost River sub-basin range from NATURAL to GOOD. In 2006, Alberta Environment undertook a water quality study in the Ghost sub-basin, and high sediment loads were measured in Waiparous Creek. Since 2008, the City of Calgary has been monitoring water quality of the Ghost River in the Hamlet of Benchlands. The most relevant challenges in the sub-basin are protection of the source waters, and managing the impacts of increasing tourism and recreation.



This sub-basin does not include the Ghost Lake Reservoir, however, the Ghost River does contribute about 7% to the inflow of Ghost Lake; the Bow River provides the remaining 93% of the inflow.

PROFILE

The Ghost River sub-basin extends from Banff National Park boundary eastward to the northern tip of Ghost Lake, and from above Waiparous Creek to just north of Highway 1A along the northern edge of the lands of Stoney Nakoda First Nation.

The sub-basin includes montane areas and rolling foothills regions which provide a parkland landscape rich in biodiversity. The eastern regions of the watershed contain large wetland complexes critically important for regulating flow in the Ghost River and providing large, natural off-stream reservoirs and filtration.

The Ghost River sub-basin covers almost 1,000 square kilometres and most of it is on public land in the Rocky Mountain Forest Reserve, within the Municipal District of Bighorn. Most of its flow comes from groundwater sources, and this helps ensure dependable year round sources of water to the Bow River, which joins up with the Ghost River just above the Ghost Dam.

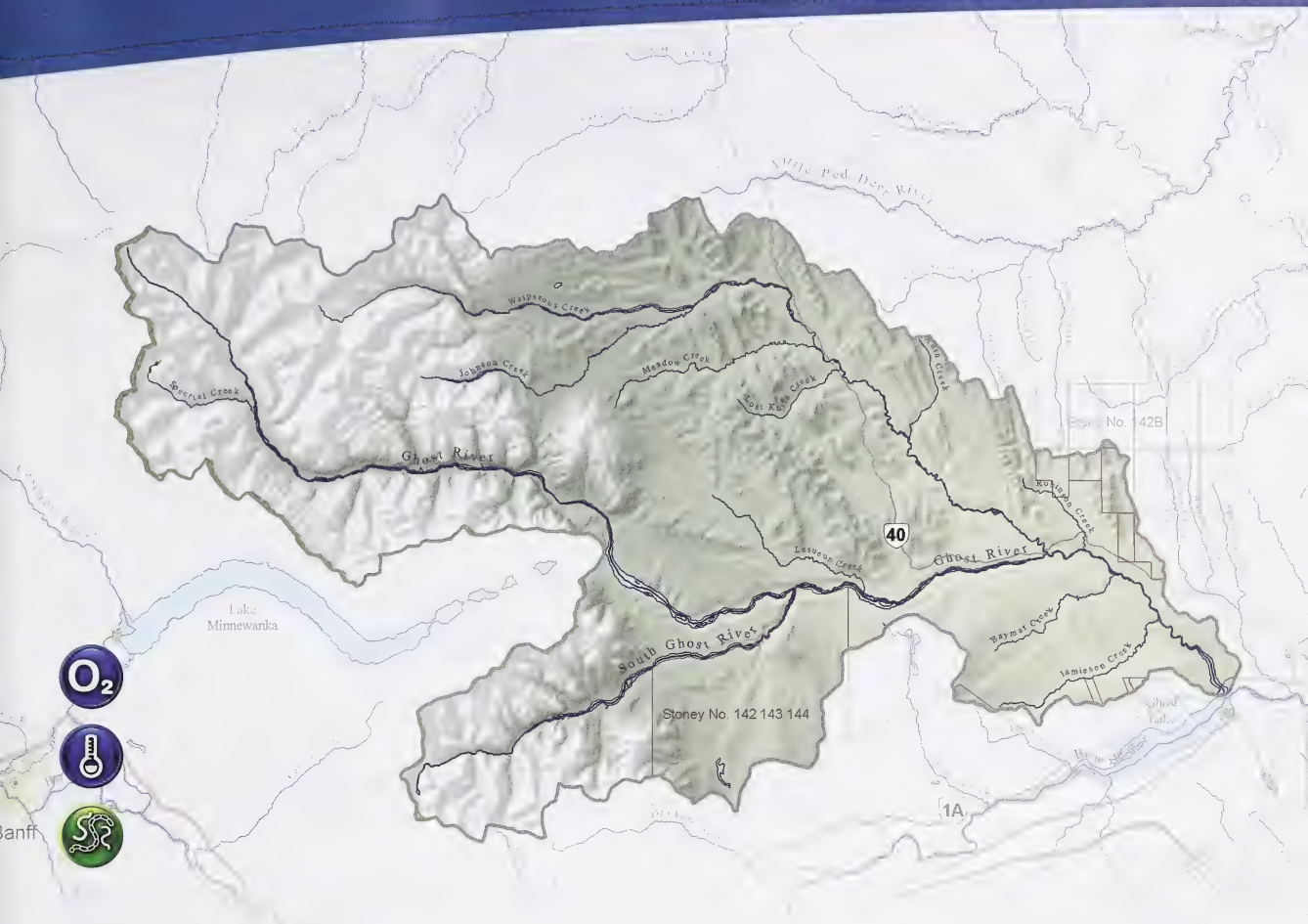
Other than the Stoney Nakoda First Nation, there are no significant or permanent population centers in this sub-basin. It is bordered by the Upper Bow River sub-basin to the west, and the Seebe-Bearspaw sub-basin to the south and west.

The Ghost River originates in the high ranges along the boundary of Banff National Park, and has two important tributaries: Waiparous Creek, and the South Ghost Rivers. Most of the flow of the Ghost River comes from the high mountains and meadows. Snow melt keeps the river flows high into the summer, and groundwater springs feed the Ghost in the fall and winter. There are a number of creeks in the sub-basin including Spectral, Johnston, Waiparous, Meadow, Lost Knife, Robinson, Baymar, and Jamieson.

CHALLENGES AND RESPONSES

The two most significant risks and pressures on the watershed are:

- water quality impacts due to erosion and sedimentation from a network of trails (the sustainability of which is in question) for motorized recreation; and,
- distribution of flow throughout the year due to climate change and some forest management practices.



The Ghost River sub-basin, located only 60 kilometres from Calgary, has seen a large increase in human activity and recreation from non-residents over the past years. The watershed itself has a relatively low population base of less than 500 people. However, on many summer long weekends more than 10,000 people have been known to use the region.

Motorized recreation, as well as industrial water use, has increased significantly in the Ghost over the past decade. As such, the area is under increasing pressure from the cumulative effects of intensive uses. However, there is a designated Forest Land Use Zone that has been established, and the Ghost Access Management Plan for Motorized Recreation (GAMP) has been put in place under the leadership of Alberta Sustainable Resources Development. While several stakeholder groups are putting in many hours of volunteer work, there are ongoing challenges in maintaining the network of designated trails in the region.

Through the collective efforts of the Ghost Stewardship Monitoring Group, a new recreation footprint is emerging in the Ghost – one that protects sensitive terrain and other ecological values such as watershed, fisheries and wildlife.

Throughout the year, the Ghost Watershed Alliance Society (GWAS) organizes several events like Walks in the Watershed. The Walks are educational, fun events showing the beauty of the watershed and the challenges being faced.

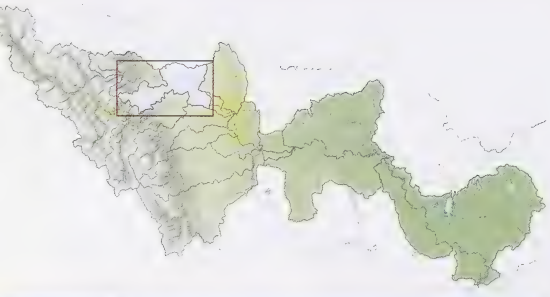
Two research projects relating to cumulative effects are being led by the GWAS: ecosystem-based planning, and riparian health assessments.

To discover more about this sub-basin, go to http://wsow.brbc.ab.ca

Seebe to Bearspaw

SNAPSHOT

The indicators for the Seebe to Bearspaw sub-basin range from NATURAL to FAIR. Water quality is monitored at two locations on the Bow River, below the Ghost Dam and at Cochrane. The riparian indicator is based on the 2003 riparian assessment by Cows and Fish, which showed that riparian areas at the confluence of the Kananaskis and Bow Rivers to the Ghost Dam were GOOD to FAIR. In addition, two of the riparian areas assessed from the Ghost Dam to Bearspaw Dam both scored as FAIR. The most relevant land use issues are the growth of municipal development and off-road recreational use.



The Seebe to Bearspaw sub-basin is where the relatively pristine Bow River comes into contact with the Town of Cochrane and nearby recreational areas (Ghost Reservoir).

PROFILE

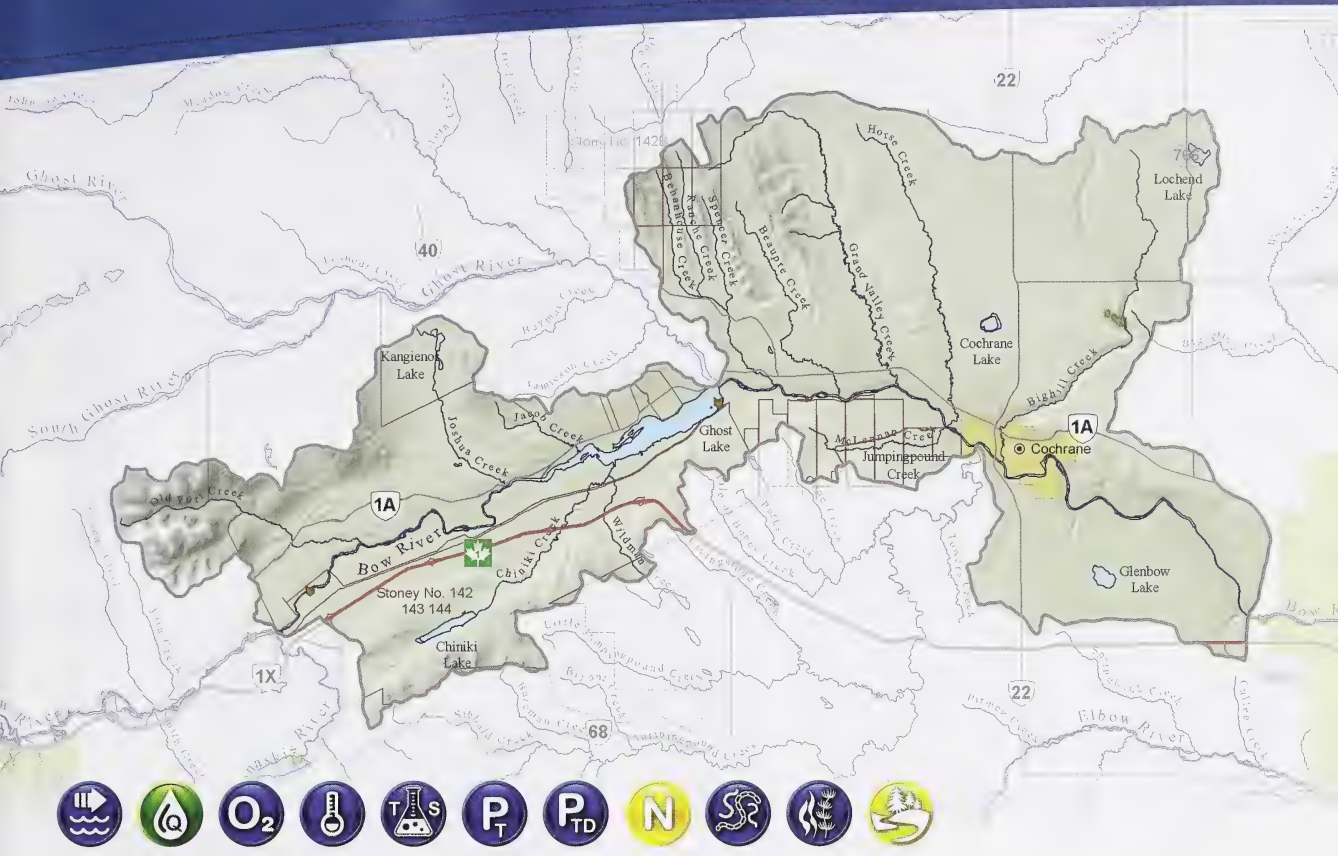
The Seebe to Bearspaw sub-basin extends from the small community of Seebe to the Bearspaw Dam in the northwest area of Calgary. The sub-basin is populated by the Town of Cochrane, the Stoney Nakoda First Nation, as well as ranchland and acreages in the Municipal District of Big Horn and Rocky View County. It is bordered by the Upper Bow sub-basin to the west, the Ghost River sub-basin to the northwest, the Kananaskis River sub-basin to the southwest, the Bearspaw sub-basin to the east, and the Jumpingpound Creek and Elbow River sub-basins to the south.

There are many lakes and reservoirs in the watershed including Chiniki, Kangieno, Cochrane, Lochend, Bearspaw and Glenbow. Several small, intermittent creeks drain into the sub-basin, including Old Fort, Joshua, Jacob, Ranche, Spencer, Beaupre, McLennan, Bighill and Jumpingpound. The Bow River provides about 93% of the inflow to the Ghost Reservoir. All outflow from the Ghost Reservoir is via the Bow River.

In 1929, Calgary Power Ltd. leased land from the local First Nations to build the Ghost Dam on the Bow River, just below the confluence of the Ghost River. The Ghost Reservoir was the result. The Ghost Dam and Reservoir are named for the Ghost River, which flows into the east end of the reservoir. A power transmission line was built from the Ghost power plant to Edmonton, and for years, this line was the backbone of Alberta's electrical system. Now, the main purpose of the reservoir is to provide power to Albertans during times of peak daily demand.

Nine species of fish are known to inhabit the Ghost Reservoir: lake trout, brown trout, mountain whitefish, lake whitefish, longnose sucker, white sucker, burbot, brook stickleback and longnose dace. Macrophytes are very sparse, as the gravel shore and fluctuations in water levels maintain a barren shoreline.

The Ghost Reservoir does not provide good nesting habitat for waterfowl because of the fluctuating water level and the absence of shoreline vegetation. However, Canada Geese are often seen at its western end during spring migration. Habitat around the reservoir is suitable for white tailed and mule deer, coyotes, badgers, Richardson's ground squirrels, Western meadowlarks and mountain bluebirds.



CHALLENGES AND RESPONSES

Some of the upstream hydropower reservoirs are used to provide power during periods of peak demand, and these operational schemes known as hydropeaking, can cause large daily fluctuations in river flow. Other issues in the sub-basin are population growth and expanded recreational use. While Cochrane is a progressive community of about 15,000, its population has been steadily increasing for the past decade and shows no signs of slowing.

To manage its environmental footprint, Cochrane has introduced a number of innovative programs to improve water management and conservation, and to ensure that wastewater is collected and treated in accordance with provincial safety standards. For example, Cochrane has introduced a three-tier water rate, a toilet rebate program, and a low flow fixture building code. It has a water conservation bylaw which limits when residents can water outside from May until October. Since the bylaw was approved in 2008, residents have reduced their average water consumption approximately 15%.

Other water conservation programs require that every building serviced with town water have a water meter to register consumption, and meters are read monthly.

Cochrane's land use bylaw requires naturescaping to a minimum of 25% of all new residential greenspace, and in 100% of commercial greenspace. Naturescaping uses native plants with mulch and other pervious surfacing material to reduce water use. The town has partnered with ExactET on a local weather station that can send information to irrigation systems so they use only the amount of water that the soil needs. Cochrane is also working to pilot irrigation systems controlled by this weather station.

Ghost Reservoir area is actively used throughout the year for boating, swimming, windsurfing, fishing and ice fishing, and for many other recreational activities.

To discover more about this sub-basin, go to http://wsow.brbc.ab.ca

Jumpingpound Creek

SNAPSHOT

The indicators for the Jumpingpound Creek sub-basin are rated as NATURAL. The most relevant issues in the sub-basin are protection of the source waters, and managing the impacts of increasing population, tourism and recreation. The proximity of the Jumpingpound Creek sub-basin to Cochrane and Calgary will require careful management of new development that requires access to groundwater. Since the sub-basin is currently closed to new surface water licenses, greater pressure on its groundwater resources is expected. As such, a better understanding of the issues related to groundwater-surface water interaction will be required.

Jumping Pound vs. Jumpingpound. There has always been some confusion regarding the spelling of Jumpingpound Creek. Historically, Jumping Pound (two words) referred to the Hamlet of Jumping Pound or the Jumping Pound community. Jumpingpound (one word) is used to describe the watercourse, Jumpingpound Creek. As you pass over the Jumpingpound Creek bridge on Highway 1, you will see both spellings depending on the direction you are traveling.

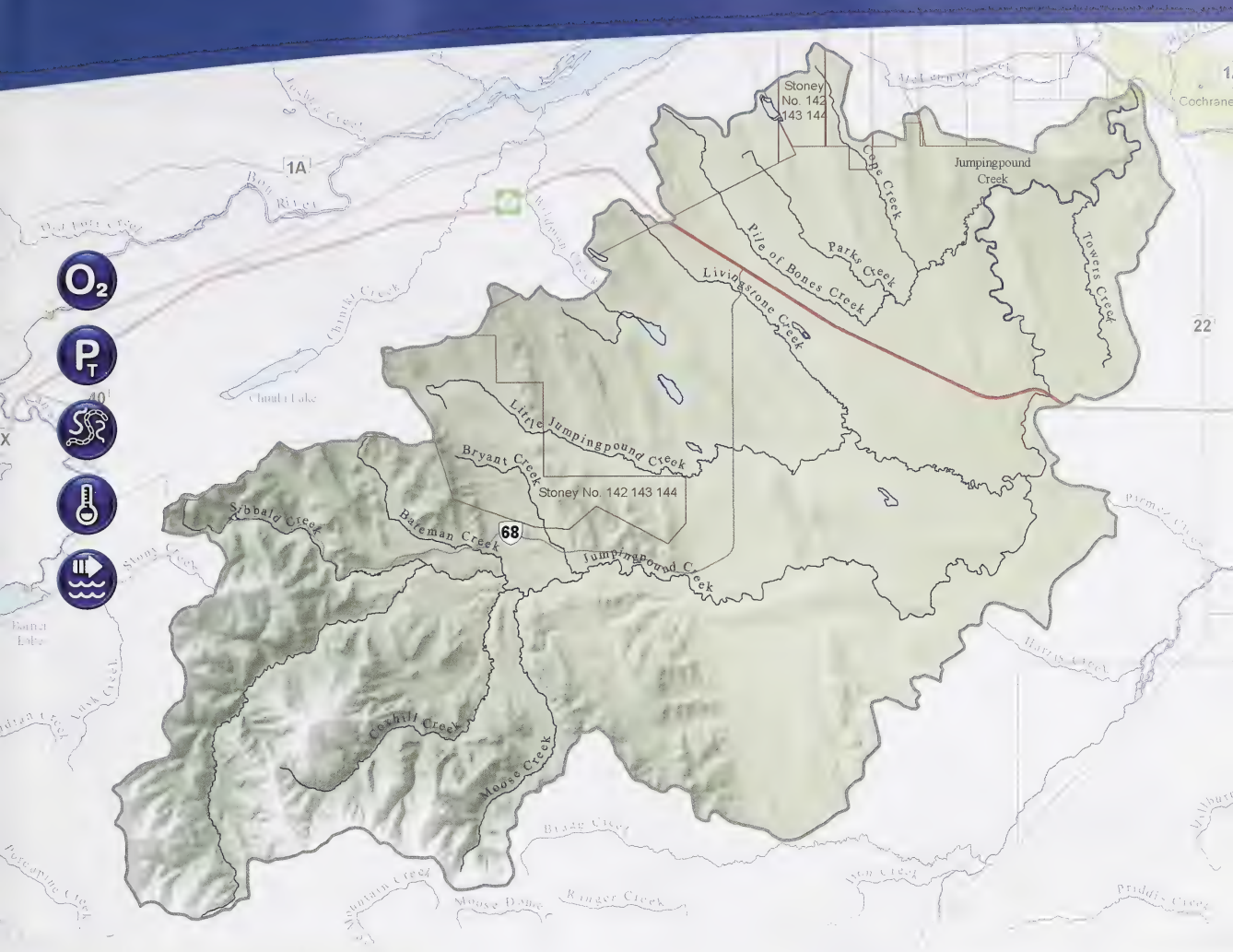
PROFILE

The Jumpingpound Creek sub-basin encompasses an area of about 604 square kilometres. It rises in the Kananaskis Improvement District and flows northeast from the Rockies for a distance of about 87 kilometres before joining the Bow River in Cochrane. The sub-basin extends over five jurisdictions, including the Town of Cochrane, Rocky View County, the Municipal District of Bighorn, Stoney Nation and the Kananaskis Improvement District. Other than a portion of Cochrane and the Stoney Nakoda First Nation, there are no significant population centers.

It is bordered by the Kananaskis River sub-basin to the west, the Elbow River sub-basin to the south and east, and the Seebe-Bearspaw sub-basin to the west, north and east. The sub-basin has a diverse landscape with elevations ranging from 2,492 metres at the highest peak to 1,123 metres at the confluence with the Bow River. In addition to Jumpingpound Creek, there are a number of other (some, colorfully named) creeks in the region including Livingstone, Pile of Bones, Sibbald, Moose, Bryant, Little Jumpingpound, and Tower.

Jumpingpound Creek contains alpine, sub-alpine, montane and foothills parkland natural sub-regions. Dominant land cover includes native grassland, cropland, and tame pasture. Farther south, the land cover is dominated by coniferous, deciduous and mixed forests, as well as extensive wetlands. Artesian springs, swamp and muskeg areas are common throughout the sub-basin.

The sub-basin is an important region that supports species habitat, wetlands, and sensitive growth areas. It provides the only habitat for trout spawning upstream of the Bearspaw Dam, and contains large muskeg areas that contribute to base flows, and to the quality of both groundwater and surface water in the area. Grassland and pasture are prevalent in the northeast portion of the watershed (lower elevations) and forested regions dominate in the southwest regions of watershed (higher elevations). Almost 62 square kilometres of the Jumpingpound sub-basin is wetland area, providing valuable habitat for animals such as moose and other ungulates, as well as many bird species. The only old growth forest north of Crowsnest Pass is located in the Jumpingpound Creek sub-basin. The area is extensively used for recreation and development purposes, especially by the forestry industry.



CHALLENGES AND RESPONSES

Overall, the watershed is relatively healthy. Water quality is generally good and quantity is sufficient to support many different species. Surface and groundwater resources are present in quantities able to sustain water demands. Almost 70% of streamflow can come from groundwater, and water quality indicators suggest that there is significant interaction between the two sources throughout the watershed. Directed by a defined management plan, active forest harvesting is occurring in the headwaters area. Designated parks and recreation areas help manage public access.

Oil and gas activity is growing, but at a slow pace. Resource extraction (sand and gravel, oil and gas) needs to be thoroughly assessed prior to development, so that activities are located in areas that will not impact local hydrology and wildlife.

Riparian assessments have documented improvements in riparian health that will support biodiversity. Invasive plants are a threat to the watershed due to past infestations on the land and the transportation corridor that is part of the watershed. There are 25 disturbance caused species and six invasive species found in the sub-basin.

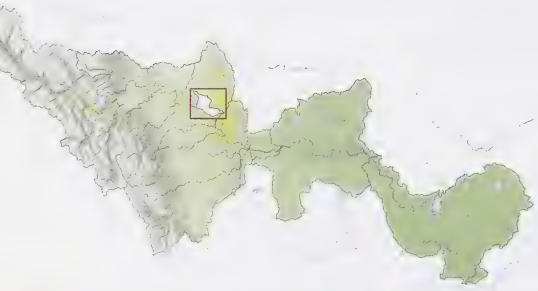
In 2009, the Jumpingpound Creek Watershed Partnership completed the Jumpingpound Creek State of the Watershed Report. This report identifies water and land resources, and outlines current pressures placed on these resources. The City of Calgary monitors water quality routinely at the mouth of Jumpingpound Creek.

To discover more about this sub-basin, go to http://wsow.brbc.ab.ca

Bearspaw to Western Irrigation District

SNAPSHOT

The indicators for the Bearspaw to WID sub-basin are rated as NATURAL. The calculated "natural flow" of the Bow River in this sub-basin shows the typical extremes in spring and summer flow rates that can be found in most rivers with headwaters located in nearby mountains. Water quality in this sub-basin is generally good, and is influenced by regulated and managed flows from upstream dams, including Ghost and Bearspaw. The riparian indicator is based on the 2003 riparian assessment by Cows and Fish, which showed that two of the riparian areas scored as FAIR.



This sub-basin begins where the Bow River enters Calgary. While there are no wastewater treatment plants located in this sub-basin, the river is beginning to experience impacts from municipal stormwater runoff and other human and industrial activities. The most significant challenges in the watershed are effective flow management of the Bow River downstream of the Bearspaw Dam, and management of stormwater runoff.

PROFILE

The Bearspaw to Western Irrigation District (WID) sub-basin extends from the Bearspaw Dam through northwest and central Calgary, and ends at the weir for the WID, located just downstream of where the Elbow River and Nose Creek join the Bow River. The sub-basin is populated by the downtown, central and northwest communities of Calgary, as well as a few rural acreages and farms in Rocky View County. It is bordered by the Nose Creek sub-basin to the north, the Seebe to Bearspaw sub-basin to the west, the Elbow River sub-basin to the south, and the Western Irrigation District to Mouth of the Highwood sub-basin to the east.

Lakes and creeks are lacking in this sub-basin as it is a relatively small and urbanized area, with the primary body of water being the mainstem of the Bow River.

The Bearspaw Dam is TransAlta's last downstream development on the Bow River. The Bearspaw plant generates an average of 70,000 megawatt hours each year, and has a capacity of 17 megawatts. The facility was built in 1954, primarily to reduce the possibility of winter flooding and ice packing on the Bow River through Calgary. It was named after Chief Bear's Paw, one of the chiefs who signed the treaty at Blackfoot Crossing in 1877.

Just downstream of the dam is the City of Calgary's Bearspaw Water Treatment Plant. Built in 1972, the plant was expanded in 1984, and has recently undergone a major $170 million upgrade to increase its capacity to 550 million litres per day – enough to fill the Scotiabank Saddledome 1.5 times per day – and to eliminate backwash solids and chlorinated discharges to the Bow River.

CHALLENGES AND RESPONSES

The Bearspaw Dam provides regulation of the river flows by reducing the daily flow fluctuations that are observed upstream during the spring and summer. Bearspaw is one of four TransAlta hydro plants on the Bow River mainstream. During the winter, these reservoirs supply twice (and more) the "natural" flow in the river through Calgary, but can also produce some large and sudden swings in these winter flows.

Major upgrades to the Bearspaw Water Treatment Plant, including the construction of a new pre-treatment and residual treatment facility, have enhanced Calgary's water treatment process and water quality, resulting in a better protected environment. The Bearspaw treatment plant now has the ability to remove debris and silt, faster and more efficiently, from the Bow River's raw water.

During 2008 testing, the facility effectively handled high turbidity events similar to those experienced in the 2005 flood. This facility sets new and higher standards of environmental stewardship. It ensures zero discharge of process waste streams into the Bow River, helping to protect our sensitive aquatic ecosystems.

The plant also protects the environment by preventing chlorinated water and sediments from entering the river. Solids are removed, then "dewatered," collected and disposed of at City landfills.

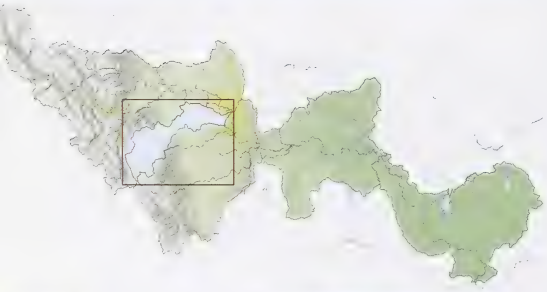
To help reduce its environmental footprint, the City of Calgary has incorporated environmental objectives into land use, urban form and transportation corridors in the 2010 Municipal Development Plan. The Plan also adopted a more compact urban form and green infrastructures to reduce the impacts of urban development on the environment and the river system.

To discover more about this sub-basin, go to http://wsow.brbc.ab.ca

Elbow River

SNAPSHOT

The indicators for the Elbow River sub-basin range from NATURAL to FAIR. Across this sub-basin, water quality indicators are measured at four locations. In general, water quality in the upper watershed is excellent. However, there is documented water quality deterioration in the more developed central and lower regions of the sub-basin. The most relevant issues are protection of source water, and managing the impacts of increasing population, development, tourism and recreation.



The focus in this sub-basin is on protecting the Elbow River's natural functions, limiting land use on the alluvial aquifer, implementing low impact development practices, increasing education and awareness initiatives, and monitoring and evaluating the actions required to meet the desired outcomes of the Elbow River Basin Water Management Plan. Increasing urban and rural developments are having significant impacts on the watershed, with urban runoff an ongoing source of river pollutants. There is evidence that activities on the alluvial aquifer, adjacent to the Elbow River, are contributing to the observed downward trend in water quality.

PROFILE

From its headwaters in the Front Range of the Rocky Mountains, the Elbow River sub-basin extends eastward to where it joins the Bow River in Calgary. At over 1,235 square kilometres, the Elbow River watershed is relatively large in area. The headwaters of the Elbow River is Elbow Lake, with the ultimate source being Rae Glacier.

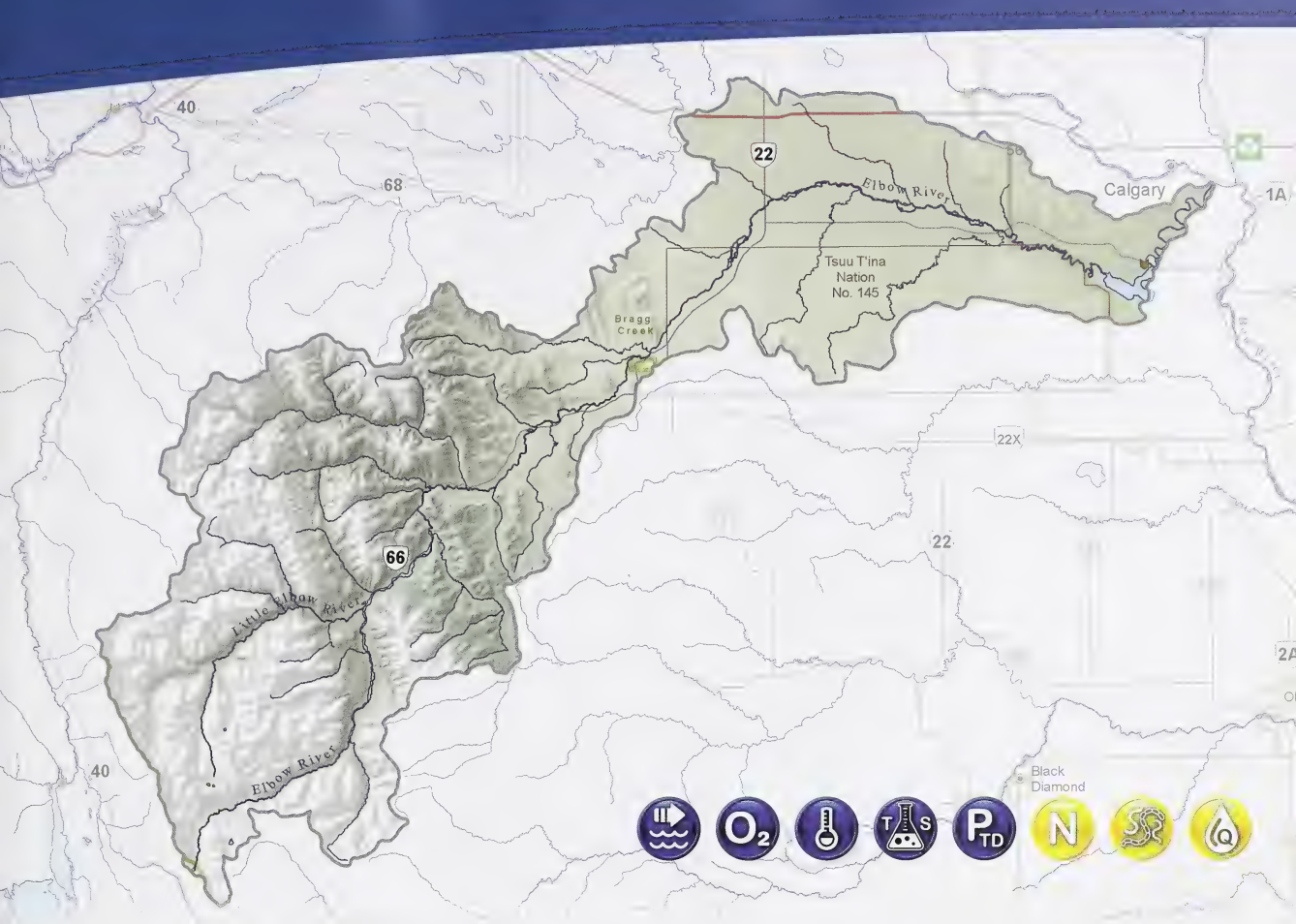
The Elbow River extends about 120 kilometres, and drops from over 2,000 metres at Elbow Lake to just over 1,000 metres when it enters the Bow River in Calgary. That is close to a 1% average slope, versus the Bow River, which drops about 2.5 kilometres over its 645 kilometre length, reflecting a 0.4% slope.

The Elbow River is unique in Canada because, for such a small river, it directly supplies the water needs for up to half a million people. Although 1/10 the size of the Bow River, the Elbow River provides drinking water to 1 in 7 Albertans, and has been a source of drinking water since 1909. The Elbow River also provides good action for brown trout, mountain whitefish, and in recent years, a growing population of northern pike.

Other than southwest and central Calgary, the sub-basin includes the populations of Bragg Creek, Redwood Meadows, ranches, and numerous acreages in Rocky View County. The jurisdictions responsible for managing activities in the watershed include the Government of Alberta, Kananaskis Improvement District, Rocky View County, Tsuu T'ina Nation, and the City of Calgary.

It is bordered by the Kananaskis River sub-basin to the west, the Highwood River sub-basin to the south, and the Jumpingpound, Seebe-Bearspaw, Bearspaw to WID sub-basins to the north, as well as the WID to Highwood, Fish Creek, and Sheep sub-basins to the east.

In addition to the Elbow and Little Elbow Rivers, there are a number of creeks in the sub-basin including Cougar, Shoulder, Nihahi, Ford, Mac, Howard, Quirk, Prairie, McLean, Bragg, Springbank, and Cullen.



CHALLENGES AND RESPONSES

Water quantity and quality are major issues in the watershed. Regarding water quality, the Elbow River watershed is experiencing increased levels of development and activity in both its rural and urban areas. While water quality in the upper watershed is generally excellent, in the more developed central and lower reaches of the Elbow River, water quality has deteriorated. Trends showing an increase in the concentrations of phosphorus, nitrogen, total suspended solids and coliform bacteria have been observed over the past decade in the Elbow River, especially around the Twin Bridges and the Weaselhead Bridge, as you enter Calgary from the west.

Demands on the Elbow River are coming from a wide variety of sources including discharges to the river, industry, agriculture, aquaculture, golf courses, oil and gas, timber harvesting, recreation, residential water users, and commercial water users. The City of Calgary maintains a comprehensive water quality monitoring network, routinely sampling 16 mainstem, tributary and reservoir stations.

The Elbow River Watershed Partnership (ERWP) was established in 2001 to support and encourage all stakeholders in the Elbow River Watershed to protect and enhance water quality and quantity. To address water quality degradation in the Elbow River and to ensure the long-term sustainability of the water resources, the ERWP brought together a multi-stakeholder steering committee to develop a water management plan for the Elbow watershed.

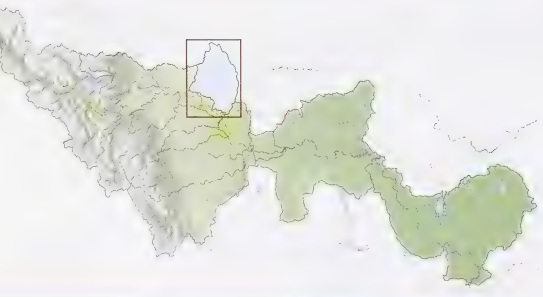
The science-based Elbow River Basin Water Management Plan, completed in 2008, provides recommendations to maintain or improve water quality in the Elbow River watershed. By December 31, 2009, all major signatories to the Management Plan had developed implementation plans and had begun to carry them out.

To discover more about this sub-basin, go to http://wsow.brbc.ab.ca

Nose Creek

SNAPSHOT

The indicators for the Nose Creek sub-basin range from NATURAL to CAUTIONARY. The most relevant issues in this sub-basin are population growth, municipal development, stormwater management, and the impacts from agricultural activities. The Nose Creek watershed is under pressure from the cumulative effects of increasing residential and commercial development, industrial growth, stormwater discharge, agricultural activity and channelization. The Bow River receives these pollutants, threatening fish and drinking water for communities downstream of Calgary.



High rates and volumes of stormwater discharge, due largely to urban growth and country residential developments, are affecting the health of Nose Creek. Valued natural features in the Nose Creek watershed, including native vegetation, riparian areas, coulees, valleys, wetlands and escarpments, are also under pressure.

PROFILE

The Nose Creek sub-basin extends north from the center of Calgary to the Town of Crossfield. Its western border reaches almost to Cochrane. The sub-basin is populated by the northern half of Calgary, the City of Airdrie, and Rocky View County. It is bordered by the Seebe to Bearspaw sub-basin to the west, the Bearspaw to WID sub-basin to the south, and the WID to Highwood sub-basin to the southeast.

There are a few small lakes in the region including McDonald, and many unnamed lakes north of Airdrie. The Nose and West Nose Creeks dominate the area as tributaries of the Bow River, and join the Bow at the most southern part of the watershed. The watershed drains an area of 989 square kilometres and is fed by numerous intermittent streams, including McPherson Coulee. The main, permanent tributary to Nose Creek is West Nose Creek, which encompasses about 33% of the entire Nose Creek Watershed area. The mainstem of West Nose Creek is about 65 kilometres in length and joins Nose Creek near Deerfoot Trail (Highway 2), directly west of the Calgary International Airport.

CHALLENGES AND RESPONSES

Urban and rural land use, namely development and agricultural activity, have resulted in degraded water quality, loss and degradation of riparian areas, an overall reduction in channel length, and, an increase in water flows above natural levels in urban areas during certain times of the year.

Riparian health and function and water quality have been compromised in the Nose Creek watershed due to elevated flows that contribute to streambank erosion, as well as encroachment by development and agricultural activity (infilling, channelization, grazing), and, alteration and/or elimination of the native plant community and natural features that protect water quality. Fecal coliforms, fertilizers, herbicides, silt and sediment enter the creek through groundwater, overland runoff and stormwater outfalls. The loss of riparian vegetation, deterioration in water quality and altered flow regime has lead to increased channel width, increased temperature and increased algae growth, and limits the distribution of coldwater fish and aquatic invertebrates in Nose Creek.

About 20% of the Nose Creek sub-basin is located within urban centers, providing for many opportunities to improve watershed management.

Water quality is monitored at four stations in the upper Nose Creek watershed by the Nose Creek Watershed Partnership (NCWP), and at four stations by the City of Calgary, within city limits. The NCWP is one group involved in the protection and rehabilitation of the watershed, and is supported by the cities of Calgary and Airdrie, Rocky View County, Crossfield, Alberta Environment, Calgary Airport Authority, the BRBC, Trout Unlimited, Cows and Fish, and the University of Calgary. The NCWP has completed a watershed management plan, and has initiated the implementation of urban stormwater volume control targets and several other projects to help protect riparian areas and improve water quality in the watershed.

The recommendations provided in the Nose Creek Water Management Plan focus on stormwater management, and aim to protect riparian areas and improve water quality by providing consistency to governing jurisdictions that are managing natural resources in the watershed. The recommendations provide guidance and a planning tool that can be used by everyone living and working in the watershed. Annual reviews of the Plan will ensure these goals are being achieved.

To discover more about this sub-basin, go to http://wsow.brbc.ab.ca

Western Irrigation District to Highwood

SNAPSHOT

The indicators for the WID to Highwood sub-basin range from NATURAL to FAIR to CAUTIONARY. While this sub-basin reflects a relatively short section of the Bow River basin, it is one of the most populated regions. The return flow in this portion of the Bow is impacted heavily from urban and human sources, such as wastewater. The most relevant issue in the sub-basin is effective management of wastewater effluent and stormwater, along with other human and industrial activities.

Human activity in this sub-basin is high and includes the Calgary Weir, many riverside pathways, highways and bridges, dog parks, and popular fishing spots. There are three City of Calgary wastewater treatment plants in the sub-basin: the Bonnybrook and Fish Creek Wastewater Treatment Plants, and the Pine Creek Wastewater treatment facility.

PROFILE

The Western Irrigation District (WID) to Highwood River sub-basin extends across the southeastern portion of Calgary, bordering the Calgary Weir, the Glenmore Reservoir, and Fish Creek Park. It ends near Okotoks at the point where the Bow River meets the Highwood River, and extends eastward just beyond Chestermere Lake, a reservoir. It is bordered by the Highwood to Carseland sub-basin to the east, and the Nose Creek, Bearspaw to WID, Elbow River, and Fish Creek sub-basins to the west, as well as the Sheep River, and Highwood River sub-basins to the south. The sub-basin is populated by communities located in eastern Calgary, Chestermere Lake, as well as rural acreages and farms in Rocky View County, and the M.D. of Foothills No. 31, which includes DeWinton, Academy and Heritage Pointe.

There are two lakes in the sub-basin: Lloyd Lake, just south of Highway 22X and north of Pine Creek, and the Chestermere Lake. The original purpose of Chestermere Lake was to act as a balancing reservoir to quickly meet fluctuating demands in the WID irrigation system. The secondary canals and reservoir right of way are owned by the WID, while most of the land around Chestermere Lake is privately owned.

The main tributaries on this sub-basin include Fish Creek, Pine Creek, Chestermere Lake, and the Shepard Slough. Many major roadways cross the Bow River in this watershed, including the TransCanada Highway 1, Highways 1A, 22, and 22X, as does the Canadian Pacific Railway. The Bow River and Fish Creek valleys provide refuge for numerous species of wildlife, such as deer, coyote, squirrel, owl, skunk, beaver, and fish (whitefish, rainbow, brown, and bull trout).

CHALLENGES AND RESPONSES

The purpose of the Calgary Weir is to increase the upstream water levels in the Bow River to allow for diversion of irrigation flows to Chestermere Lake and the Western Irrigation District via the Western Headworks Canal. Although the weir functions well to satisfy its intended purpose, its design has created an extremely dangerous hydraulic roller that has claimed several lives, and has been referred to as "the drowning machine". The Calgary Weir also represents the only impassable barrier to boaters and fish in the 100 kilometre reach of the Bow River from Bearspaw Dam to the Carseland Weir. Through the Harvie Passage project, scheduled to be completed by 2012, modifications are being made to the Calgary Weir to improve safety, recreation and upstream fish passage.

In Calgary, wastewater flows by gravity through several thousand kilometres of underground pipes to the Bonnybrook, Fish Creek or Pine Creek wastewater treatment plants. Bonnybrook serves the area north of Glenmore Trail. The Fish Creek plant serves the area south and east of the Glenmore Reservoir. The new Pine Creek plant treats up to 100 million litres of waste water a day, and expanded, it will be able to process 700 million litres a day. Once treated, the water is released into the Bow River, and the separated sludge is recycled as a fertilizer and soil conditioner on local farms (Calgro program). While the storm drainage system is self-supported by user fees, the wastewater drainage system is a self-supporting utility.

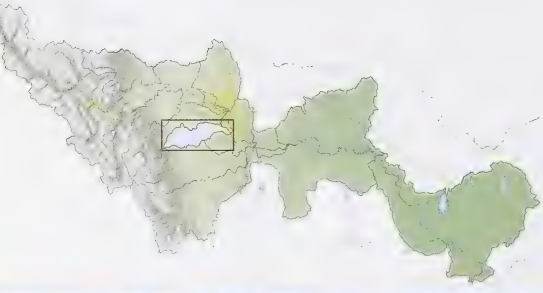
The City of Calgary recently implemented the Shepard Stormwater Diversion Project to provide a route for stormwater on the east side of the city to reach the Bow River. The project will intercept stormwater from areas of southeast and northeast Calgary and the Elliston Storm Pond, directing flows to a constructed wetland and finally to a conveyance channel terminating at the Bow River. A diversion structure will also reduce high flows in the Western Headworks Canal that flows into Chestermere Lake.

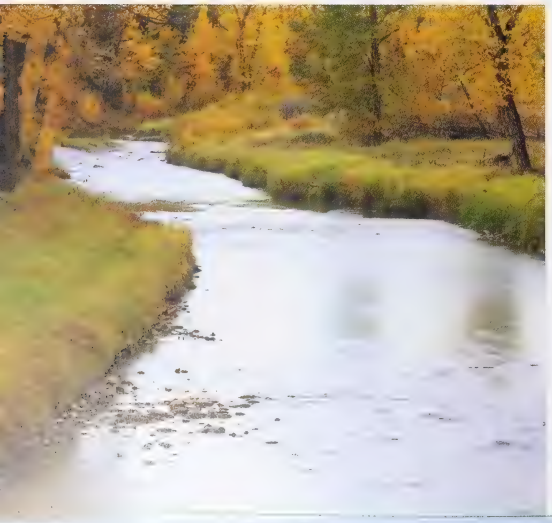
To discover more about this sub-basin, go to http://wsow.brbc.ab.ca

Fish Creek

SNAPSHOT

The indicators for the Fish Creek sub-basin are rated as NATURAL. It is unlikely that Fish Creek Provincial Park adds contamination to Fish Creek as the Park is designated as a natural area. Pesticides that are used to control invasive plant species are not allowed within 30 horizontal metres of the riverbanks to prevent runoff from contaminating the Creek. The most relevant issues in the Fish Creek sub-basin are protection from and management of increasing recreation and human use of the park, as well as agricultural and stormwater runoff.





Stretching from one end of Fish Creek Provincial Park to the other is a network of engineered wetlands that represents one of the largest in Canada. With help from the City of Calgary, local communities, and regulatory authorities, this Park is a fine example of working together to improve water quality.

PROFILE

The Fish Creek sub-basin extends from the southwest of Calgary, in the foothills of the Rocky Mountains, to where Fish Creek connects with the Bow River in the extreme southern region of Calgary. The sub-basin provides an exceptional recreational and park area for many Calgarians. Fish Creek is home to a wide variety of wildlife including elk, deer moose, bear, coyote, cougar, squirrel, porcupine, beaver, blue herons, snakes, amphibians and fish. The fish species found in this watershed include rainbow trout, brook trout, brown trout, mountain whitefish, brook stickleback, longnose, cutthroat trout and white sucker. Other creeks in the region include Whiskey and Priddis.

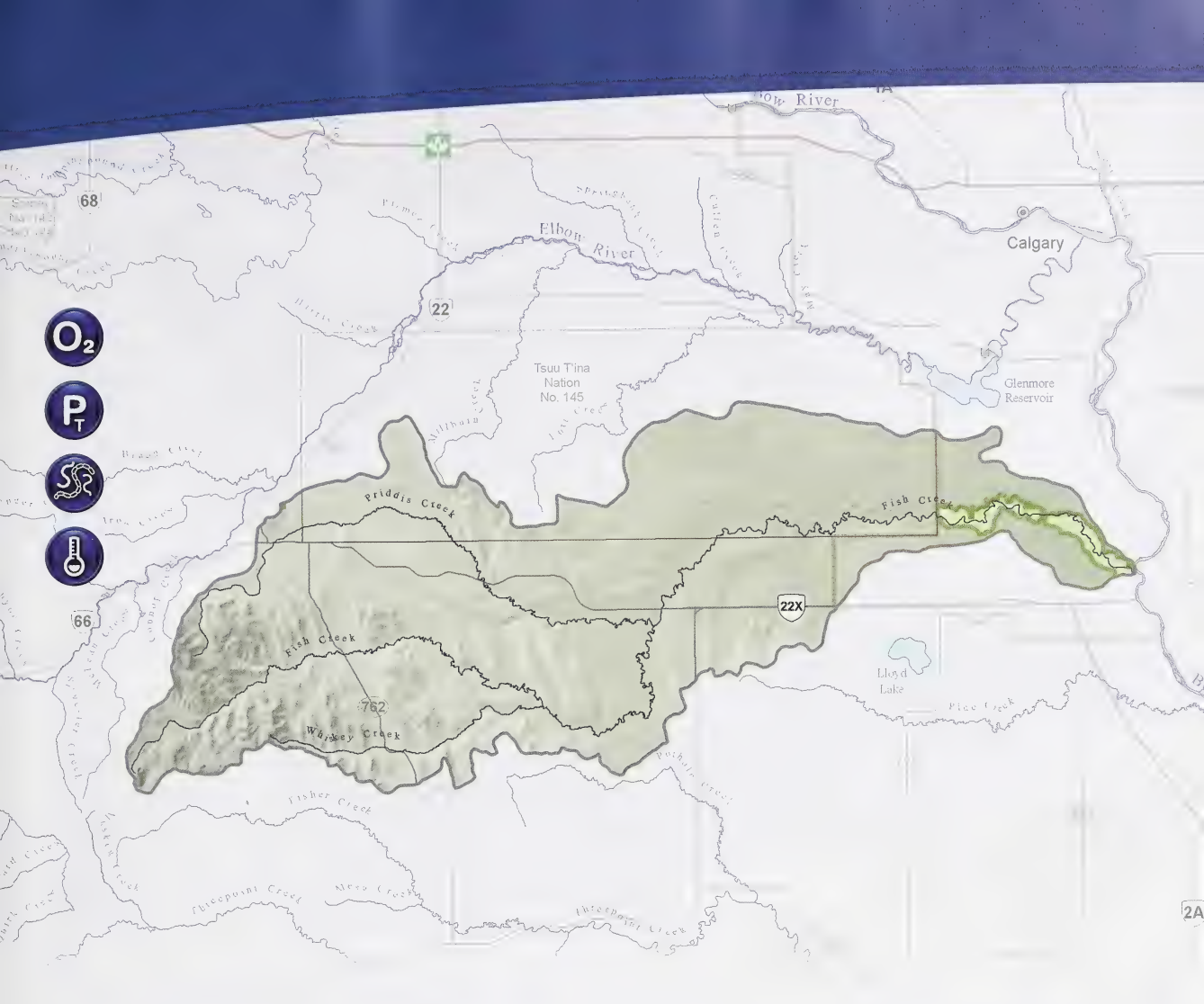
The sub-basin runs through Fish Creek Provincial Park, which is one of the largest urban parks in North America, stretching 19 kilometres from east to west. At over 13 square kilometres, it is more than three times the size of Vancouver's Stanley Park. The growth of Calgary has left the park bordered on all sides by the city. It is also bordered on the west by the territory of the Tsuu T'ina First Nation.

Fish Creek Provincial Park is protected under the Provincial Parks Act. The Provincial Parks Act ensures that the park is maintained for the conservation and management of the native flora and fauna, and for the preservation of both natural and cultural landscapes and features. Protection efforts extend to preserving the water quality of the creek.

CHALLENGES AND RESPONSES

There are a number of potential sources of water quality degradation in Fish Creek. Upstream land use is predominantly focused on agriculture, primarily cattle grazing, livestock operations, and grain farming. The Tsuu Tina First Nation is also located in the Fish Creek watershed immediately upstream of Calgary, although it does not have intensive land use compared to the surrounding areas.

Likely sources of water quality degradation include upstream land use, off-highway vehicle use, random camping, and stormwater runoff from the City of Calgary. Eleven stormwater outfalls drain runoff into Fish Creek from surrounding areas. Prior to 2007, this stormwater was largely untreated. However, the City of Calgary has retrofitted five of the eleven stormwater outfalls with end-of-pipe treatment wetlands, and these constructed wetlands have significantly improved the quality of the stormwater runoff into Fish Creek.



In addition, a new partnership with the Rotary Club of Calgary has enabled the development of a new wetlands area south of Highway 22X. The Chinook Nature Park, near the west bank of the Bow River within Fish Creek Provincial Park, will handle stormwater from the Deerfoot Trail roadway. Any water entering the Bow River will do so as seeping groundwater, well cleansed of human pollutants.

In fact, without the Park's extensive network of engineered wetlands, many of the sediments, chemicals, and other harmful materials would run directly to Fish Creek, and then into the Bow River. Some of the wetland vegetation is planted after construction or development, but many of the plants grow naturally from seeds transported by wind, water, and animals. These wetland communities develop quickly and provide habitat for a diversity of insects, birds, amphibians, and mammals.

Fish Creek Provincial Park has an ongoing invasive plant management program. There is a four part plan that is working to reduce the impact of invasive species on the park's habitat, and will help stop the spread of these troublesome plants.

In 2007-08, water quality was monitored monthly at five locations along the Fish Creek by the Friends of Fish Creek Provincial Park Society. Benthic macro-invertebrates were also examined during the summer of 2008 at all five sites to establish a baseline for any future studies. Water quality data is also being collected at Fish Creek by the City of Calgary.

Highwood to Carseland

SNAPSHOT

The indicators for the Highwood to Carseland sub-basin range from NATURAL to FAIR to CAUTIONARY. The most relevant issues in this sub-basin are stormwater and wastewater runoff from the Calgary region, as well as runoff from agriculture production. Given the watershed's proximity to the wastewater and stormwater outflows leaving the Calgary region, these conditions are not surprising, but remain a reason for concern.

The Highwood to Carseland sub-basin is facing significant and growing challenges in balancing future urban and rural development from the Calgary region with agricultural land use. While the region has prospered economically, it has also created unplanned and unexpected effects on water quality, groundwater, wildlife and fish, working farms and ranches, and natural areas.

PROFILE

The sub-basin extends from where the Bow River meets the Highwood River southeast of Calgary, eastward to where the Bow River reaches the Carseland Weir, and extends from Dalemead Lake southward to Third Lake. It is bordered by the WID to Highwood and Highwood River sub-basins to the west, and the Carseland to Bassano sub-basin to the east. Water for the Bow River Irrigation District (BRID) is diverted from the Bow River at the Caresland Weir. Lake McGregor Reservoir, Travers Reservoir, and Little Bow Reservoir are the major water storage reservoirs for the BRID.

Other than Dalemead and Indus, there are no significant population centers in the sub-basin. With the exception of Dalemead Lake (located in the northern region of the watershed), there are relatively few significant or permanent water bodies in the region.

The sub-basin is among the lowest elevations in the Bow River basin, and flows through a floodplain that supports riparian poplar forests. It is also home to some of the most popular fishing destinations along the Bow, complete with large numbers of big rainbow and brown trout, as well as the occasional bull, brook and cutthroat trout.

The Highwood to Carseland sub-basin provides a habitat to many animals, a destination for anglers, and a water source for agriculture. The sub-basin also has a much slower flow than the Upper Bow since the terrain in this region is primarily prairie grassland. The prairie provides a healthy habitat for coyote, mule deer, whitetail deer, Richardson ground squirrel, red tail hawk, and many other bird species.

CHALLENGES AND RESPONSES

The distance from the point where the Bow River meets the Highwood River to the Carseland Weir is a relatively short section. As such, water quality in this sub-basin is heavily influenced by upstream conditions in the Highwood River, Sheep River, and by urban development in the Calgary region.

The Highwood and Sheep Rivers drain a very large area that is being used primarily for agriculture and ranching. The most significant point source influences on water quality are Calgary's wastewater treatment plants, located upstream.

However, the City of Calgary has incorporated more advance wastewater treatment technology and processes, and has significantly reduced suspended solids, organic material, bacteria, and nutrient loadings. Some of these loadings are substantially below historical levels, despite the large increase in Calgary's population.

The health of the Bow downstream of Calgary is reflected, in part, in the health of its downstream fisheries. The region downstream from Calgary to the Carseland Weir provides one of the finest trout sport fisheries in North America, and is among the best in the world. Nutrients from Calgary's wastewater treatment plants contribute to the productivity of the stretch of river from Calgary to Carseland. The extensively treated wastewater still contains sufficient nutrients to encourage aquatic plant and insect life, which provides a rich diet to various species of fish, particularly rainbow and brown trout. However, there is still a need to find a balance between natural water and wastewater management coming from the Calgary region, as well as the Highwood-Sheep watersheds to assure beneficial management of this valuable aquatic ecosystem.

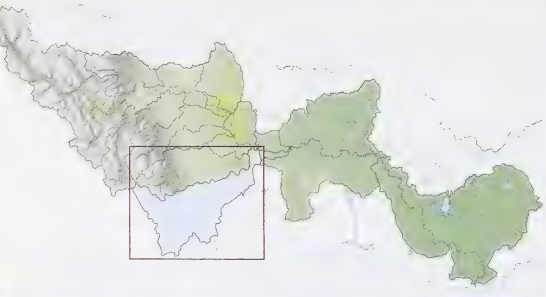
Given its proximity to the Calgary region, this sub-basin will continue to be impacted by the significant and growing level of human activity and economic development occurring upstream and within this sub-basin. In response, a number of initiatives including the Land Use Framework's South Saskatchewan Regional Plan, the Calgary Regional Partnership, the Bow River Basin Watershed Management Plan, and the Highwood Management Plan are attempting to address many of the economic development and environmental and water management issues within this sub-basin and the region.

To discover more about this sub-basin, go to http://wsow.brbc.ab.ca

Highwood River

SNAPSHOT

The indicators for Dissolved Oxygen and for the River Flow Quantity Index were recorded on the Highwood River near the mouth of Bow River. Both indicators were considered to be within NATURAL levels. The most relevant issues in the sub-basin are protection of the headwaters, diversions from the Highwood River during low flow periods, and managing the impacts of increasing population, tourism and recreation. Water quantity and quality, regional planning, and protection of the aquatic habitat are also ongoing challenges across the sub-basin.



Management of water quantity and quality in the sub-basin has generally focused on the diversion of water from the Highwood River to the Little Bow watershed located in the Oldman River Basin. Diversions have been ongoing for the past century and their impacts on the lower Highwood during low summer flows has led to the development of the Little Bow Project (2004), and development of a revised Highwood Diversion Plan (2008), as part of the Phase 1 Highwood Management Plan (2008).

PROFILE

The Highwood River sub-basin extends from the eastern slopes of the Rocky Mountains below Peter Lougheed Provincial Park, eastward to the Town of High River, and then north to where the Highwood River joins the Bow River, just southeast of Calgary. The Highwood has its headwaters in the Highwood Range of the Rocky Mountains, and flows through the towns of Longview and High River before joining the Bow River. The Highwood River is approximately 162 kilometres in length, and the sub-basin drains an area of 2,412 square kilometres.

The major population centers in the Highwood River sub-basin include High River, Longview, and Eden Valley. It is bordered by the Kananaskis River sub-basin to the northwest, the Sheep River sub-basin to the north, and the WID to Highwood, Highwood to Carseland, and Carseland to Bassano sub-basins to the northeast. The Highwood extends through numerous provincial and wildland provincial parks.

The Highwood River has no major impoundments, and water use primarily consists of diversions to the Little Bow, and licensed withdrawals for irrigation, livestock watering, and municipal purposes. Municipal wastewater from the town of High River and the MD of Foothills industrial park are piped into Frank Lake, which spills into the Little Bow River. However, there is growing concern over increasing levels of municipal wastewater return flows and other non-point source loadings that are impacting the Highwood River, downstream from the confluence of the Sheep River.

The river is a very popular recreation destination for hiking, fishing, rafting, kayaking, wildlife spotting, and biking. Land use in the Highwood River sub-basin includes forestry, recreation, oil and gas operations, ranching, and agriculture.

The Highwood River and its tributaries have one of the most successful fish habitats in the Bow River basin. High canyons and deep pools in the alpine and sub-alpine portions of the watershed make the river an ideal location for spawning. The sub-basin offers a mountain connected contiguous aquatic environment for fish spawning, rearing, and wintering habitats that supports sport fishery downstream of Calgary. Fish species include rainbow trout, brook trout, bull trout, cutthroat trout, and mountain whitefish.

CHALLENGES AND RESPONSES

The Little Bow Project supports diversions from the Highwood River into the Little Bow River and Mosquito Creek in order to supply Twin Valley Reservoir, and the Clear Lake Reservoir. Following public hearings in 1997-98, the Little Bow Project was approved, but judgment was reserved on the issue of diversions from the Highwood River during the low flow periods in July and August. This led to the formation of a multi-stakeholder community group, the Highwood Management Plan Phase 1 Public Advisory Committee (PAC), to develop recommendations concerning these diversions.

Between 2001 and 2006, the PAC succeeded in creating a set of recommendations with broad community support. Based on a scenario that achieved the best balance between diversions for water supply and protection of the Highwood River fishery, Alberta Environment prepared a revised Highwood Diversion Plan.

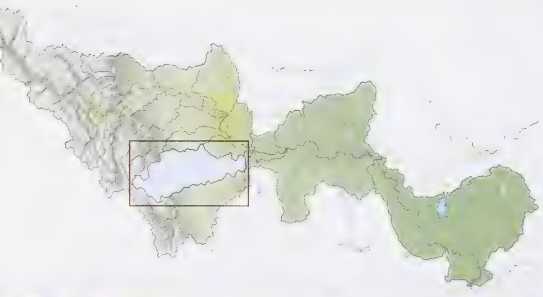
In June 2008, the first phase of a comprehensive Water Management Plan for the Highwood (upstream of the Sheep-Highwood River confluence, and the Little Bow River upstream of the Travers Reservoir) was submitted to the Natural Resources Conservation Board and Alberta Environment. The plan was based on the recommendations of the PAC, and was prepared with guidance from Alberta Environment and the Environmental Law Section of Alberta Justice, and was approved in 2008. The next phase of this work has begun, with a focus on integrating the Sheep River tributary into the plan, and setting up an implementation process to address Phase 1 commitments. Landowner groups are also actively involved in stewardship projects on several creeks including Pekisko, Stimson, and Mosquito with the goal of improving land use and riparian management strategies throughout the watershed.

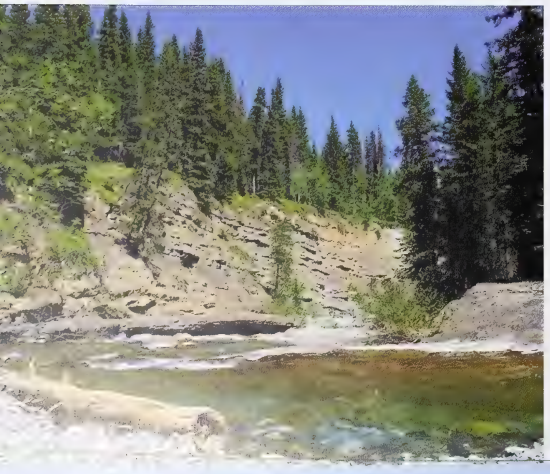
To discover more about this sub-basin, go to http://wsow.brbc.ab.ca

Sheep River

SNAPSHOT

The most recent River Flow Quantity Index value recorded on the Sheep River at Black Diamond was for 2008 annual flows, and the indicator was considered to be within NATURAL levels. The most relevant issues in the sub-basin relate to improving water quality and quantity management given increasing population, development and recreation. Water quality in the upper Sheep River is generally good, but there's water quantity and quality management challenges in the more developed central-lower regions of the sub-basin that have implications for sustaining the health of the Sheep River, and the lower Highwood River.





A growing number of industrial and residential developments are now using the Sheep River as their main source of water, and an increasing amount of stormwater and wastewater runoff is also draining into the Sheep River. While these pressures are being experienced across the sub-basin, there is an acute challenge with access to water to support development in and around the Town of Okotoks.

PROFILE

The Sheep River is an important tributary sub-basin of the Highwood River watershed. This sub-basin originates in the mountain valleys of Elbow-Sheep Wildland Provincial Park in the Highwood Mountain Range of Kananaskis Country. The river flows east through Sheep River Provincial Park, connecting with the Highwood River about 8 kilometres east of Okotoks.

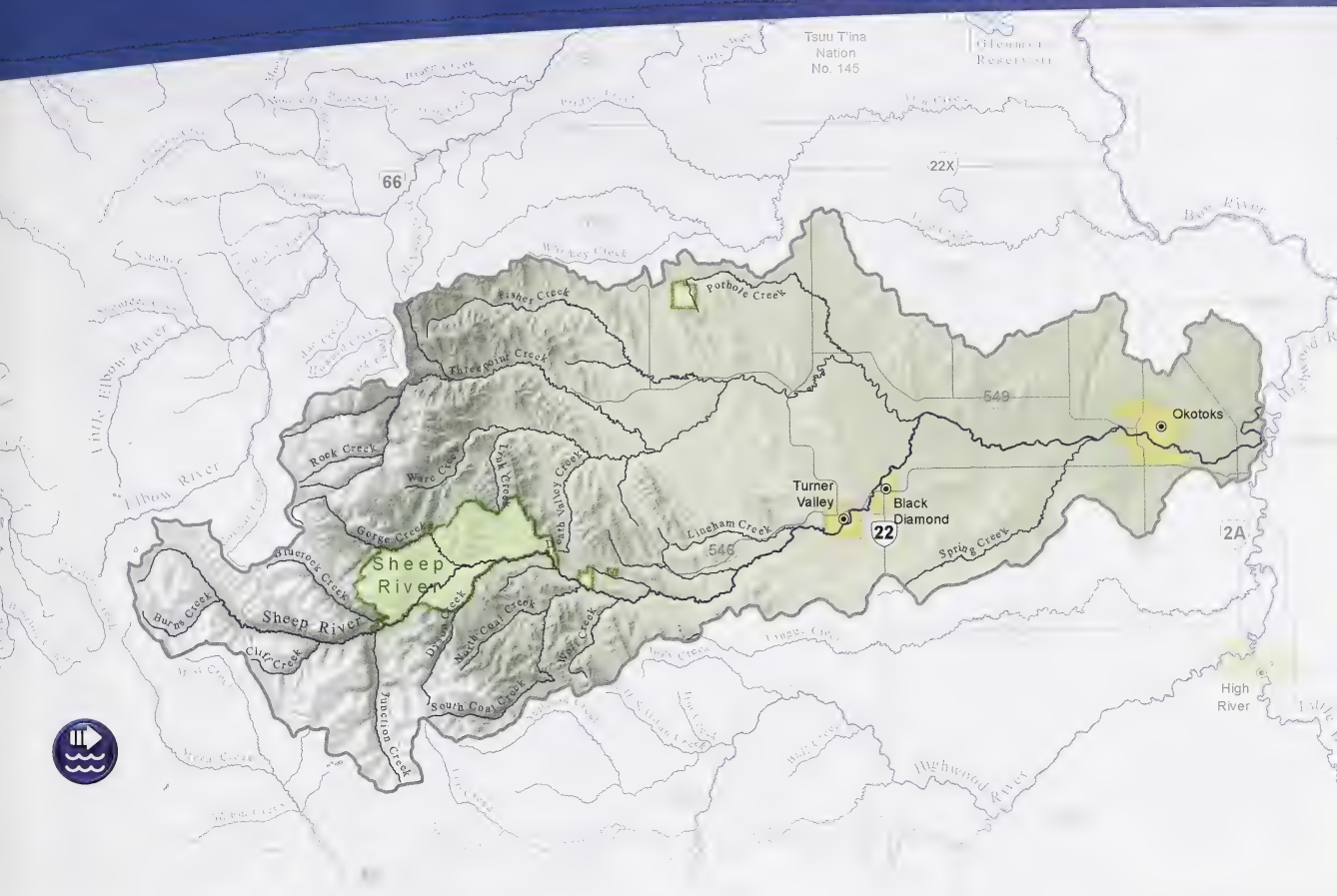
The Sheep River is 107 kilometres long and drains an area of 1,573 square kilometres that forms along the northern edge of the Highwood River sub-basin. After flowing through Okotoks, the Sheep River joins the Highwood River, which then flows into the Bow River just southeast of Calgary. It is bordered by the Elbow sub-basin to the west, the Fish Creek and WID to Highwood sub-basins to the north, and the Highwood sub-basin to the east and south. The Sheep River is the municipal water source for the towns of Turner Valley, Black Diamond, Okotoks, and a variety of acreages, farms and ranches.

In addition to the Sheep River, which serves as the primary tributary to the Highwood River, there are a number of creeks that serve as tributaries including Burns, Cliff, Bluerock, Junction, Wolf, Link, Threepoint, Death Valley, Lineham, Fisher, Pothole and Spring.

The terrain in the Sheep River sub-basin varies from alpine, to sub-alpine, to foothill parkland, and finally prairie. The upper most reaches of the Sheep River are only accessible by foot or horseback.

Sheep River Provincial Park includes the former Sheep River Wildlife Sanctuary which provides year-round habitat for bighorn sheep, moose, bear, coyote, cougar, squirrel, beaver, eagle, and hawk.

The upper reaches of the Sheep River have, over time, carved massive canyons through the mountains and foothills. This has created deep pools and small waterfalls, a perfect habitat for fish such as mountain whitefish, rainbow, brook, bull, and cutthroat trout. The Sheep River fishery provides a mountain connected contiguous ecosystem that supports the spawning, rearing and wintering habitats for the highly valued Bow River sport fishery downstream of Calgary.



CHALLENGES AND RESPONSES

The Sheep River sub-basin doesn't drain a very large area. However, it contains many tributaries in steep mountain terrain, and as such, water quality is usually degraded in the spring due to the considerable amounts of erosion caused by mountain runoff and snow melt. Increasing demand for water has also driven municipalities to consider new opportunities to collectively improve water management across the sub-basin, especially in Turner Valley, Black Diamond and Okotoks.

The need for a more coordinated and regional approach to water and wastewater management in the Highwood River and Sheep River sub-basins has led to a number of inter-municipal initiatives such as Black Diamond's plan to study alternatives to upgrading the Town's water treatment plant.

One possible solution could be a regional water and wastewater treatment facility servicing Black Diamond, Turner Valley, Longview and other small communities.

While water use in Okotoks is carefully managed and conserved, it has faced significant challenges in securing new sources of water for its future. This has led to an extensive search to find available water licenses for transfer under the Water Act. In response to its water supply challenges, Okotoks has introduced a number of programs to improve water management and conservation, and to ensure that wastewater is collected and treated in accordance with provincial safety standards.

To discover more about this sub-basin, go to http://wsow.brbc.ab.ca

Carseland to Bassano

SNAPSHOT

The indicators for the Carseland to Bassano sub-basin range from NATURAL to GOOD to FAIR to CAUTIONARY. Low water flows are one of the key contributing factors to poor riparian health. The greatest consumptive use of water in this sub-basin is for irrigation from the Carseland Weir. The Western Irrigation District (WID) also covers some of the land base of this sub-basin. Pressure on water resources from population growth is expected to increase in the future, especially in Strathmore and Wheatland County. Irrigation demand for water is expected to increase in the future, although the Irrigation Districts are implementing several new conservation programs and technologies.

The Carseland to Bassano sub-basin extends from the Carseland Weir, winds its way through the prairie, east to the Siksika Nation, and continues upstream of the Bassano Dam. It also extends from the northern tip of Deadhorse Creek, southward to the Town of Vulcan.

PROFILE

The Carseland to Bassano sub-basin is bordered by the Highwood to Carseland and Highwood River sub-basins to the west, and the Bassano to Oldman sub-basin to the southeast. It is also bordered by three Irrigation Districts (Western Irrigation District, Eastern Irrigation District, and Bow River Irrigation District).

The sub-basin is populated by the Towns of Strathmore and Vulcan, as well as Carseland, Hussar, Standard, Strangemuir, Namaka, Mossleigh, Farrow, Arrowwood, Anastasia, Shouldice, Queenstown, Majorville, Stobart and Gleichen. In addition, Wheatland County is located on the north side of the Bow River and Vulcan County on the south side of the river. The Siksika Nation is also located in the sub-basin. The total length of the sub-basin is 126 kilometres, and it drains an area of 4,291 square kilometres. There are several lakes in the sub-basin including Eagle Lake, Deadhorse Lake, Namaka, Alkali, Third, and Stobart Lake.

The main tributary is Crowfoot Creek, which enters the river from the north near Bassano. West Arrowwood Creek, the second largest tributary, enters the river from the south near the town of Arrowwood. There are other creeks including East Arrowwood and Parflesh.

The watershed in this sub-basin is located within the grassland natural region, characterized by mixed grass vegetation and a low relief landscape. Mammals include mule and white tailed deer, pronghorn, coyote, fox, white tailed jackrabbit, and Richardson's ground squirrel.

The most common birds are sparrows, larks, longspurs, falcons, northern harriers, and hawks. The vertical cliffs also provide nesting habitat for falcons and geese and staging habitat for a variety of birds. Waterfowl, including mallards, scaups, redheads, canvasbacks, pintails, shovelers, tundra swans, pelicans, and blue winged, cinnamon and green winged teals, are common on the prairie wetlands. The watershed also provides important habitat for snakes, frogs and salamanders.

A transition from coldwater fish habitat to cool water fish habitat occurs in this sub-basin. The most common fish species in the upper part of the sub-basin include mountain whitefish, rainbow trout, brown trout, longnose sucker, and white sucker. Northern pike and burbot are found in the upper part of the sub-basin. In the impounded area upstream of the Bassano Dam, northern pike are the most common sportfish species.

CHALLENGES AND RESPONSES

Future water allocations throughout the South Saskatchewan River Basin will need to result from conservation efforts and the transfers of water allocations. In this regard, the agriculture and irrigation sectors will play a significant and growing role. There are many promising agricultural and irrigation practices and technologies being used in the region that are increasing crop yields while reducing the impact of growing crops on water resources. Irrigators are becoming more efficient water managers and users. The challenge is how to balance the economic value of our agricultural and water resources with the desire to promote conservation and maintain a healthy aquatic ecosystem.

Agriculture is the main use of land in the sub-basin, and features dryland and irrigated crops, livestock operations and feedlots.

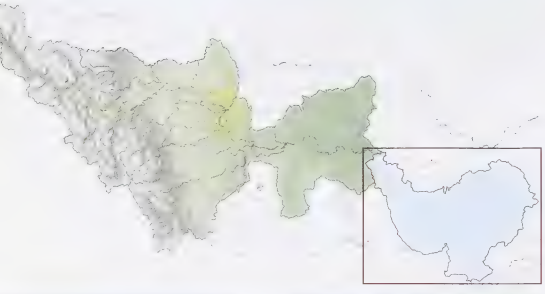
There has been an increase in oil and gas exploration and development in recent years, which is likely to continue into the future. Along with the Bassano to Oldman River sub-basin, this sub-basin also has some of the highest oil and gas development activity in the Bow River basin.

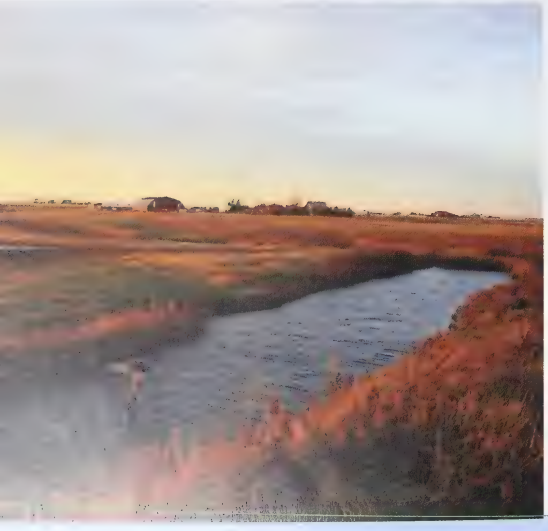
To discover more about this sub-basin, go to http://wsow.brbc.ab.ca

Bassano to Oldman River

SNAPSHOT

The indicators for the Bassano to Oldman sub-basin range from NATURAL to GOOD to FAIR to CAUTIONARY. During certain periods, river flow rates downstream of the Bassano dam are reduced to levels potentially threatening to the health of the aquatic ecosystem. Water quality in this sub-basin is impacted by wastewater effluent and surface water runoff from agricultural cropland, as well as impacts on riparian vegetation, bank stability, siltation and water quality from livestock operations.





The greatest consumptive use of water in the sub-basin is water diverted for irrigation from the Bassano Reservoir. The Bassano Dam is the headworks for the Eastern Irrigation District (EID), which withdraws water through a series of canals for storage in the EID's off-stream reservoirs.

PROFILE

This is where the story of the Bow River basin reaches its conclusion!

Here, the Bow River flows southeast from the Bassano Dam through the prairie to the confluence with the Oldman River, an area called the Grand Forks. The northeast side of the river is located within the County of Newell, while the southwest side of the river is located in the Municipal District of Taber and the County of Vulcan. The total length of the sub-basin is 185 kilometres, and it drains an area of 5,357 square kilometres. Smaller intermittent tributaries include the New West Coulee, Coal and Twelve Mile Creeks, which can be augmented by irrigation flows.

The EID covers a large portion of the northeast side of the sub-basin, and the Bow River Irrigation District (BRID) covers most of the southwest side. Reservoirs in the EID include Lake Newell, Rolling Hills, Kitsim, Tilley B, and Cowoki Lake. At 6,285 hectares, Lake Newell is the largest man-made lake in Alberta. Reservoirs within the BRID include Badger, Lost Lake, D and H Reservoirs, and Scope.

The communities of Bassano, Brooks, Tilley, Duchess, and Rosemary, the County of Newell, and three Hutterite colonies all draw water from the canals or reservoirs of the EID, though they have separate municipal licenses and their water use is calculated separately from the EID allocation. Some of the water allocated for municipal diversions is returned to the Bow River, via the EID channels, in the form of treated effluent discharges. Return flows from Bassano, Brooks and Duchess are transferred to the Red Deer River basin via the EID infrastructure. Vauxhall, Lomond, Milo, and the Municipal District of Taber draw water from the BRID, which diverts water from the Carseland Weir. The "other" water licenses include uses for golf courses and recreation areas.

Across the region, the landscape is mainly low relief, with some sagebrush flats as well as dune and sand plain complexes. The dry mixed grass prairie is less agriculturally productive, but has a more diverse landscape with higher wildlife populations than other prairie reaches.

Wildlife in the Bassano to Oldman River sub-basin includes grassland species such as white tailed and mule deer, pronghorn, coyote, white tailed jackrabbit, and Richardson's ground squirrel. Common birds include the horned lark, sharp tailed grouse, hawks, and pheasants. There are northern pike, walleye, and lake sturgeon in the Bow River, as well as pike, lake whitefish, and walleye in the BRID and EID reservoirs.

CHALLENGES AND RESPONSES

Agricultural activities in the sub-basin include dryland and irrigated agricultural crops, livestock operations, feedlots, and meat packing plants. In the County of Newell, more than 80% of the farms use irrigation for crop production and more than 50% of the farms focus primarily on raising beef cattle.

Feedlot manure accumulates in large quantities, and is sometimes applied to fields more heavily than the land and vegetation cover can assimilate. As such, excess nutrients run off into surface waters or leach into the groundwater.

Pesticide concentrations in surface waters have been found to be directly correlated to the amount of pesticide applied locally. Elevated herbicide concentrations have been found during spring runoff, indicating that some herbicides persist in the soil over the winter. However, these non-point source influences are difficult to quantify and little specific information exists regarding their impact on water quality.

Within the Bow River Basin, this region has the highest amount of oil and gas development. Historically, oil and gas development has been widespread, and this is likely to continue. There are now more than 30,000 oil and gas wells in the County of Newell.

Recorded flows in this sub-basin are lower than those in the rest of the Bow River basin, with the exception of the headwaters. Flows are particularly low during the summer and fall months. During certain periods of most years, river flow rates downstream of the Bassano Dam are reduced to levels potentially threatening to the health of the aquatic ecosystem. Reduced flows are caused by high demand to irrigate fields and to refill reservoirs in the irrigation districts prior to the spring runoff and again prior to winter closure of the canals.

To discover more about this sub-basin, go to http://wsow.brbc.ab.ca

HIGHLIGHTS

The Bow River basin is a large, diverse and highly managed river system that varies greatly along its length, both in terms of the status of its water resources and impacts from human activities. In some sub-basins, water quantity is adequate, water quality is improving and aquatic ecosystems are generally healthy. However, the health and status of the river deteriorates along its length and there are some significant and growing issues of concern (climate change, land use, impacts from population growth and economic development).

Fortunately, there are many reasons to be optimistic about the future health of this valuable resource.

Summary

We live in the Bow River basin, a remarkable tract of land that extends from the Rocky Mountains, across foothills and the City of Calgary, to the broad prairie. This land has been home to First Nations for thousands of years. We share this water with plants and animals. Without this water, nothing could live. With this water, a great diversity of life, including humans, can thrive.

As residents of the Bow River basin, we must respect the land that produces the life-giving waters. However, we face many challenges. Our rapidly growing population demands much of the land and water. Our climate is changing and the future of our water supplies is uncertain. To act wisely, we need first to understand our basin.

WHAT THIS REPORT TELLS US

Agriculture, energy, and economic development over the last century have transformed southern Alberta. However, water remains the significant limiting factor to population growth, economic development and environmental protection in the region. Whether one considers irrigation, tourism, recreation, or economic development in urban and rural areas, water has been, and remains the key to unlocking new opportunities.

The four major watersheds in the South Saskatchewan River Basin (SSRB) - the Red Deer, Bow, South Saskatchewan and Oldman Rivers - are all managed watersheds. However, as the most populated and regulated river system, it is the Bow River basin that has the most diverse and intensive demand for water, and holds the most promise for improved water management over the long term.

In most sub-basins of the river, the average annual flow of the Bow is almost always adequate for the many licensees and environmental requirements. However, during certain periods of the year, in certain sub-basins of the river, the flow is not always adequate to meet desired environmental requirements and satisfy the demand from all of the licensed diversions.

Since the total amount of water available in a watershed in a given year is a set amount, there are two logical responses to an imbalance between water demand and supply during some portion of the year. The first response is to improve conservation, efficiency, and productivity of existing and future water use. The second response is to store more water during high flow periods, for later release during low flow periods.

Much has been written about the shortage of water in southern Alberta, as well as the near certainty that the situation will worsen in the immediate future. The BRBC is working to stimulate new thinking and innovative opportunities for improved water management, water storage, flood and drought planning. The longer term goal of this report is to operationally change how water is managed as a system throughout the region, and drive needed changes to water policy, conservation and use.

MAKING PROGRESS

Many recent studies and reports provide a general context and advice for further progress. However, now is the time to take the next step and discuss realistic, practical and innovative actions in specific sub-basins of the Bow River basin. Several seemingly intractable problems are each part of an integrated water management system that can be understood and improved. Options to anticipate and mitigate the consequences of all but the most extreme conditions are available to us today.

In this regard, the current regional planning processes that are being engaged as part of the Land-use Framework provide an unprecedented opportunity to adopt near-term actions in support of a long-term perspective. A major priority of this work is to improve water risk management, storage, water assignments and water conservation objectives.

This report discusses several existing and promising opportunities to further protect the waters of the Bow River basin, while improving both environmental and economic conditions throughout the basin, with the potential to provide some additional risk protection against drought and flood.

NEXT STEPS

Providing an improved understanding of the current state of the watershed is a vital first step in developing an adaptive management framework that enables the research, actions, and best practices needed to improve the health of the watershed.

There currently exists some significant (and several minor) data and information gaps with many of the BRBC SOW indicators. With funding and program reductions to water monitoring programs across the province, the BRBC, and all Alberta WPACs and Watershed Stewardship Groups continue to face a significant and growing challenge to monitor and report on the health of their watersheds.

In spite of these difficulties, and with the support of dedicated and volunteer-based members and organizations, much of the readily available indicator data and information has been identified, analyzed and incorporated into the BRBC WSOW tool. Going forward, the BRBC believes it is critically important to resolve and address gaps in water data and information, in order to develop a strategic and systematic approach towards the sustainable management of this watershed.

Efforts to address these data, information and knowledge gaps are underway, and if you or your organization has any water information, knowledge, stories, images or videos that you would like to share, we encourage you to contact the BRBC.

FUTURE OPPORTUNITIES

The Government of Alberta is now reviewing potential changes to how water is allocated, transferred and traded. Albertans will have an opportunity to provide input on the future water rights system. The outcome will determine how water is allocated among human needs, the economy, and the environment.

There is a growing amount of research on the impacts of climate change, and understanding the scale and scope of our "water footprint" and the total volume of freshwater used to produce the goods and services consumed by individuals or by a community.

There are many other positive accomplishments and changes to build on going forward. Some of these opportunities include promising new technologies and programs that can improve the recovery, recycling and reuse of water. There are many new programs and organizations dedicated to promoting open dialogue and collaboration around environmental stewardship and water management.

Our watershed is big, beautiful and bountiful, and we are grateful for the opportunities it has given us. The BRBC and its partners are committed to supporting the development of new programs and opportunities that ensure information and knowledge of our water resources is the foundation for sustainable development, enhanced conservation and stewardship, and effective decision making.

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